

REPORT OF A COMMITTEE

OF THE

Central Board of Irrigation

ON

Distribution of the Waters

OF THE

Indus and its Tributaries.

1st. to 8th. March 1935,
17th. to 20th. June 1935.



VOLUME III.

Proceedings and Appendices.

(Confidential.)

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PART VII.

MINUTES OF PROCEEDINGS.

Committee on the Distribution of the Waters of the Indus and its Tributaries.

Minutes of proceedings at the meetings of the Committee from the 1st. to the 8th. of March, 1935, and from the 17th. to the 20th. of June, 1935.

PREFATORY NOTE.—The minutes of the meetings recorded below, are practically verbatim. The record is paragraphed and numbered serially for ease of reference. The interpolations in italics have been inserted wherever necessary to clarify the narrative and to facilitate cross references.

The Committee consisted of the following :—

Mr. F. ANDERSON, C.I.E., I.S.E.	..	..	Nominated by the Government of India.
Mr. F. A. BETTERTON, I.S.E.	..	..	Do.
Mr. W. L. C. TRENCH, I.S.E.	..	..	Sind.
Mr. H. W. NICHOLSON, C.I.E., I.S.E.	..	..	the Punjab.
Mr. A. ORAM, I.S.E.	..	..	N.-W. F. P.
Sir BERNARD DARLEY, Kt., C.I.E.	..	..	Bahawalpur.
Mr. T. A. W. FOY, I.S.E.	..	..	Bikaner.
Mr. J. M. SLADEN, I.C.S.	..	..	Khairpur.
			and
Mr. A. M. R. MONTAGU, I.S.E.	..	..	Secretary, Central Board of Irrigation as Secretary to the Committee.

The Members of the Committee together with their advisers assembled in Old Delhi between the 25th. and 28th. of February, 1935. The first meeting took place at 10-30 a.m. on the 1st. March.

2. The proceedings were opened by the Honourable Sir Frank Noyce, K.C.S.I., C.B.E., I.C.S., who was accompanied by the Hon'ble Mr. D. G. Mitchell, C.S.I., C.I.E., I.C.S., Secretary, Department of Industries and Labour and Mr. E. M. Jenkins, I.C.S., Deputy Secretary.

The Honourable Sir Frank Noyce opened the proceedings with an address to the Committee as follows :—

3. **Sir Frank Noyce :** The subject to deal with which you have been called together, is of such importance to three Provinces in India, the Punjab, Bombay and North-West Frontier Province and the three Indian States, Bikaner, Bahawalpur and Khairpur, that when a suggestion was made that I should open your proceedings I very gladly consented to do so as it gave me an opportunity of wishing you on behalf of the Government of India all success in your very difficult task. The controversy about which you are to make what I am certain will be a manful attempt and I hope will be a successful one—to settle, is in itself an indication of the progress made in the development of irrigation in recent years. It is only when the resources of a great river system have been fully assessed, and projects for the complete utilization of those resources have been executed or at least sketched out, that competing claims for the supply of water assume first class importance.
4. As you know, my Department has no longer a Consulting Engineer for Irrigation, much less an Inspector-General, and you, Gentlemen, are therefore much more familiar than any officer now serving in it with the details of the prolonged discussions upon the use of the waters of the Indus and its tributaries. It is not altogether inappropriate that I should be here to-day, for the need for what might now be described as "planning" was first recognized some 16 years ago by two members of the Indian Cotton Committee of 1919, of which I was Secretary, and before which Mr. Nicholson appeared, to give very valuable evidence.
5. That Committee attached great importance to the Sukkur Barrage Project, and the two members to whom I have referred, the two non-official members, Messrs. Wadia and Hodgkinson, felt so strongly about its importance that they recommended that until the Project had been executed or abandoned, no further irrigation projects affecting the Indus supply should be undertaken in the Punjab. It is

of some interest that this far-reaching recommendation was relegated to a footnote, for it gave rise to discussions which were destined to continue for 10 years.

6. In 1929 the Indus Discharge Committee propounded an *ad interim* solution which was accepted both by Bombay and the Punjab. The effect of this solution was to postpone a final decision for a further period of 10 years, that is to say, until 1939. During that period, data to justify a final decision were to be collected, and the Punjab was to be entitled to a limited supply for the Haveli Project. Other developments were to be held in abeyance, subject to the results of a special enquiry into the Bhakra Dam Project.

7. The reasons why the Government of India reopened the discussions within the period of 10 years laid down by the Indus Discharge Committee, were stated in our circular letter of the 8th. November 1934, in which the appointment of the present Committee was proposed. Briefly, the position is that certain claims advanced on behalf of Khairpur and Bahawalpur demand immediate settlement, and that the Punjab is anxious to obtain an additional supply for the Haveli project. Members have doubtless observed that Head I of the TERMS OF REFERENCE requires the Committee to examine and report upon the extent to which additional supplies are actually required for the Khairpur State, the Bahawalpur State and the Haveli Project. So far, the scope of the Committee's deliberations is not wide. But under Head II, which deals with the possibility of finding the additional supplies and the effect of any fresh withdrawals that may be recommended, discussions are likely to range over the problem of distribution as a whole.

8. The Government of India hope that, although the Committee will be concerned primarily with the allocation of additional supplies for specified purposes, their report on the possibility of finding those supplies may offer a permanent solution of a very vexed question. I should like to add that if during the deliberations of the Committee it is found necessary to expand the draft terms of reference, the Government of India will authorize the Chairman to do so.

9. Members from the Provinces and States which are actively interested will, I am sure, be very grateful to Mr. Anderson and Mr. Betterton for consenting to serve on the Committee, and for the trouble they have taken to acquaint themselves with the details of an unfamiliar and difficult problem. I need hardly emphasize that the main essential for a successful outcome of the Committee's labours is an atmosphere of co-operation. Without reasonable give and take no solution which is generally acceptable, is likely to be arrived at, and as the terms of reference show, the Government of India would be most unwilling to impose upon the parties an unacceptable solution. A settlement of the immediate claims, coupled with a permanent adjustment of the whole controversy would be an achievement of the greatest value. I am sure that you will all spare no effort to arrive at conclusions which are reasonably satisfactory to all parties. It would be too much to hope that they will be enthusiastically welcomed by all parties, for we cannot in this world hope to get all that we desire. As I said at the outset, you have the warmest wishes of the Government of India for the successful conclusion of your labours.

10. **Mr. Anderson :** On behalf of the Committee and myself, I beg to propose a most cordial vote of thanks to the Hon'ble Sir Frank Noyce for opening our proceedings to-day.

The proposal was carried with applause, after which Sir Frank Noyce left the meeting accompanied by Mr. Mitchell and Mr. Jenkins.

11. Mr. Anderson then took the Chair and began the formal business of the meeting.

NOTE.—The two Independent Members, Mr. F. Anderson and Mr. F. A. Betterton, had met on 27th. February and framed ISSUES based upon the study of the BRIEFS of the Interested Parties. These ISSUES had been distributed to Members of the Committee on 28th. February, and were before them when Mr. Anderson rose to address them.

The original ISSUES are reproduced as Appendix I-(A). During the meeting, modifications were introduced, and the final form assumed is reproduced as Appendix I-(B).

12. **Chairman :** The Hon'ble Member, Sir Frank Noyce, has very kindly explained why this Committee has been appointed. All I need mention now is the procedure we propose to adopt. The detailed BRIEFS received from the parties need not be

discussed, because every member has received a copy of each BRIEF. These BRIEFS can be referred to whenever necessary during our deliberations; they will be accepted as evidence and placed on the records. In order to facilitate our discussions we propose to frame definite ISSUES. A copy of our draft ISSUES has been supplied to each member and our first business is to frame the final ISSUES after considering any modifications desired by the members of this Committee. After the ISSUES have been decided on, each one will be taken up separately. Many, if not all of the ISSUES will entail lengthy and general discussions. We do not consider it is necessary to maintain a verbatim record of these general discussions. We consider it will suffice if, after the general discussion is over, each member will kindly dictate his opinion and views which will be recorded verbatim. A copy of each day's proceedings will be given next morning to each member for verification and amendment. We suggest that the Committee should meet daily from 10 a.m. to 1 p.m., and 2-30 p.m. to about 4-30 p.m. except on Sunday, when the afternoon meeting will not be held.

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13. **Chairman :** The first thing to discuss this morning is the framing of each ISSUE.
14. **Mr. Nicholson :** At the present moment, I would suggest that further points may arise in the discussion before us, and probably something will develop.
15. **Mr. Foy :** I agree with that. I think we cannot take these ISSUES as final now, as we may have to add to them later on.
16. **Mr. Trench :** Should not schemes under development receive prior consideration to any new schemes ?
17. **Mr. Foy :** Conversely, there is the question which has been brought up by the Bikaner State. Take the first ISSUE, *viz.*, "Should the non-perennial areas receive perennial water" ? Supposing the Committee decide that non-perennial areas should not receive perennial water. Can Bikaner claim that certain non-perennial areas in the original project should now be changed into perennial areas ?
18. **Chairman :** That would not come under discussion in this ISSUE.
19. **Mr. Foy :** But it is a converse to Mr. Trench's proposal. I think, once the principle is settled that non-perennial areas should not receive perennial water, the question could be very carefully examined during the discussion, to see if it will cut across existing agreements. We should first see whether we should give a prior right to existing agreements in their initial stage of development rather than to future projects.
20. **Mr. Trench :** Is it not possible to take a correction factor of value for perennial and non-perennial and treat it as all one area ? I think something like that exists in the 1920 Agreement.
21. **Chairman :** Will you suggest your draft ?
22. **Mr. Trench :** I suggest :—"Should existing commitments in regard to utilization of water receive prior consideration to future projects"—to put it in the most general terms. This seems to me to be a basic ISSUE
23. **Chairman :** Could it not come under ISSUE No. 8 or 9 ?
24. **Mr. Trench :** I don't think so, because these ISSUES seem to treat the whole area available for irrigation as one unit and to consider the advisability of fixing a percentage of withdrawal for each party, irrespective of what their commitments up to date have been. If you had a clean slate, no doubt ISSUE No. 6 indicates the best method of going to work.
25. **Mr. Nicholson :** It was not my suggestion that existing commitments should be tampered with.
26. **Chairman :** What is the general feeling about the issue proposed by Mr. Trench ?
27. **Mr. Foy :** I should object to it as a basic principle.
28. **Chairman :** If it is admitted, it does not necessarily come under No 1. I suggest we should discuss No. 1 first.

29. **Mr. Foy :** The question really arises as to whether we are to discuss the Sutlej supplies or not. There are two sides to No. 1, and therefore you need to settle that question first.
30. **Chairman :** Our terms of reference from the Government of India are :—
“ The extent to which supplies of water are actually required for (a) the Khairpur State, (b) the Bahawalpur State and (c) the Haveli Project.
31. **Mr. Foy :** So that the Sutlej is completely out of it !
32. **Chairman :** I think it is, if we adhere to the Government of India's terms of reference.
33. **Mr. Trench :** What I have in mind, is in my view, axiomatic. The definite application would crop up in many of these points at issue. The question of whether non-perennial areas should not receive perennial water would also arise, so that this ISSUE No. 1 is of limited application.
34. *A member enquired what Mr. Trench's proposal was.*
35. **Mr. Trench :** “ Should existing commitments receive priority rather than future projects ”.
36. *It was agreed to add this after ISSUE No. 5.*
37. **Chairman :** I suggest that Mr. Trench's suggestion should be put into No. 5 as No. 5 (a) or 5 (b).
38. **Mr. Trench :** There is one modification to No. 5. I don't know whether October to June covers everything. The question of September is sometimes very important. I suggest September to June instead of October to June.
39. *This was accepted. No other suggestions were forthcoming.*
40. **Chairman :** I propose that we should take up ISSUE No. 1. I will ask Mr. Nicholson to open the discussion.
41. **Mr. Nicholson :** Non-perennial areas are I take it, as defined in this Glossary of Terms.⁽¹⁾ It does not mention the word “ khadir ” and in the Punjab, non-perennial canals or branches are designed to irrigate what is called the “ khadir ”. Apart from channels in the khadir certain others are non-perennial.
42. If you turn to the blue prints tabled, showing the irrigation on all the canals in the Punjab,⁽²⁾ you will see that on the Upper Bari Doab, Sirhind and Lower Chenab canals there are non-perennial channels. Owing to irrigation, the spring level rose and waterlogging actually occurred or was threatened. It was decided that the necessity for giving rabi water for these areas had ceased and was detrimental because, with the channels running up till October, rabi crops could be sown and matured by irrigation from wells. This change commenced about 1905. When the Upper Jhelum and Upper Chenab canals were constructed, there were areas in which the spring level was under 40 feet. Speaking generally, these areas were given kharif irrigation only, as from past experience it was seen that to irrigate an area perennially, with high spring level was undesirable.
43. In the same way on the Lower Chenab canal, which was an old canal, the rise of spring level caused several distributaries to be converted from perennial to non-perennial and some closed altogether. It was on this experience that the Sutlej Valley Project was designed, and due to the fact that there was an immense area which could not all be irrigated perennially, the parties concerned agreed to the exclusion of the khadir area from perennial irrigation.
44. When the project was submitted to the Government of India, they raised objections in their letter No. 15-I of 11th. January 1921, to certain areas being made perennial. The reply from the Punjab Government in No. 190-WI of 15th. January 1921, was to the effect that this area was not khadir land. In view of the fact that a project was under consideration for giving controlled supplies, the conversion of this

(1) Central Board of Irrigation Publication No. 5 “ Glossary of Technical and Vernacular Terms in connection with Irrigation in India, together with Standard Notations ”. See also Part I Vol. I of this Report.

(2) Appendix II, (A) and (B).

inundation irrigation to perennial, did not in any way controvert the principle at stake. In the Haveli Project there are considerable areas on inundation canals to which the Punjab have no desire to apply perennial irrigation.

45. It is known in the Punjab full well from past experience, what the effect of putting too much irrigation water in a tract may be. By replacing the existing inundation canals in the area to be brought under command by the Haveli Project, by a non-perennial canal, supplies will be assured from the early kharif right up to 15th. October and on the perennial canal, supplies will be restricted in the rabi to 0·3 capacity in December, January and February. Under such irrigation methods, the wells in the tract (3) will be worked and maintain the sub-soil water table level steady which will avert any adverse effects.

46. It should please be borne in mind that at the present moment, I am not in any way querying any action which has been taken in Bahawalpur State under this question of giving perennial irrigation in khadir land. Since the khadir question has been brought up, I may say that the original maps on which the areas were taken out by Bahawalpur State and accepted by them, are available here for reference, and they may be of value in the consideration of any proposals regarding the conversion of khadir non-perennial areas into perennial.

In support of this principle regarding the restriction of irrigation in khadir areas to non-perennial, it will not be out of place to quote the opinion expressed by the Council of Regency in Bahawalpur State and of their eminent Consulting Engineer, Sir John Benton. The Council of Regency, in their note (4), dated the 12th. January 1920, (end of para. 1) stated "The proposed utilization of a large portion of the perennial water supply in the irrigation of khadir land is, we would submit, unnecessary, and its effect, we hope, will be remedied".

At the end of para. 6 "The proposal to cut down the intensity of irrigation appears to have for its object the provision of a rabi supply for irrigation of Government khadir lands in the Nili Bar for which a rabi supply is not required".

47. So far that has been the opinion of the Council of Regency. We now come to the note by the irrigation officers which follows, in the 1920 representation (5).

In paragraph 4 "The omission of proposals for conferring perennial irrigation on Government khadir areas will greatly improve and regularise the scheme, and therefore the matter requires a very careful consideration to prevent unnecessary waste. If these khadir lands were included now in the perennial areas, we believe the mistake will require correction eventually and the water made available will then have to be made over to Bahawalpur for use in high lands".

48. In Part II at the end of paragraph 9, in Statement A, Right Bank, items 2, 5, 6 and 9 refer to specific areas of khadir lands regarding which doubts were expressed. At the end of this paragraph they refer to additions made; "64% added to the area proposed to be given perennial supply though in khadir which has been barred from having available water diverted to it".

Again, further down the page below, "The total area of the khadir lands—includes all land from the "dhaya" on one side, to the river edge shewn on the maps, including all lands that receive direct inundation, is 3,049,382 acres".

Paragraph 12: "Transfers from non-perennial to perennial—All these transfers relate to the Khadir which is not supposed to receive perennial irrigation".

Page 23: paragraph 28(b): "The proposed use of part of the perennial irrigation on khadir lands, where it is really not necessary, is contrary to a past declaration of the Punjab and also contrary to the past practice in the Province".

	No. of wells.
(3) Sidhnai area	6,350
Chenab inundation canals area	7,505
Muzaffargarh canals area	2,800
Total	16,655

Figures for 1932-33 from "Statistics of Irrigation Water Distribution and Working of Distributaries of the Canals in the Punjab."

(4) Note of January 1920, of the Council of Regency, Bahawalpur State on the various schemes advanced for utilizing the waters of the Sutlej and Beas Rivers in the Lower Punjab.

II.—Note by Sir John Benton dated 21st. December 1919.

49. I think Sir, it is unnecessary for me to add any further expression of opinion to what I have been able to quote from the most eminent irrigation authority we have known in India.
50. **Chairman :** What is your personal opinion ?
51. **Mr. Nicholson :** I consider that perennial irrigation of khadir land is a procedure which brings disaster and ruin in its train.
52. **Chairman :** I should like to know Sir Bernard Darley's view on ISSUE No. 1.
53. **Sir Bernard Darley :** I will follow the line of Mr. Nicholson's argument. I will take, although it is not in the TERMS OF REFERENCE, the portions of Bahawalpur which are fed from the Sutlej. My definition of khadir lands would be those areas lying within a certain distance of the river or those which lie below the high bank of the river or " dhaya " as it is called in the Punjab.
54. In connection with the Eastern Sadiqia canal to which he referred, certain lands he said, were allowed perennial irrigation although they had received inundation canal water previously, because they were on high land above the bank of the river. The engineers who built this Eastern Sadiqia canal went further, and they took the " dhaya " as the actual boundary and quite rightly too. The Sutlej Valley Enquiry Committee, when they went round, also added some high lands which had previously received spasmodic inundation irrigation. In the Eastern Sadiqia canal there is no proposal to give the low lying river valley any irrigation.
55. I now come to that with which we are concerned, that is the Panjnad area. The Sutlej Valley Committee recommended that the perennial supply to which Bahawalpur is entitled, should be given to an area designed for non-perennial irrigation south of the railway. All this land lies not less than 16 miles from the river to-day, as you will see from the map. In the olden days, before the river embankments had been built, heavy floods used to pass down over the country, to this area. Later when these embankments were built and canals constructed, the tendency was to give the irrigation water to lands nearer and nearer the river, and a great deal of this area south of the railway went completely out of cultivation except in a very few small patches. The vast majority is State or proprietary waste which never received canal water at all. To all intents and purposes, it is at the present time a desert. Therefore, I do not include this area within the khadir.
56. I am not sure whether the point in Mr. Nicholson's remarks is that this non-perennial area should not receive perennial water. For the rest I entirely agree with Mr. Nicholson. Where the spring level is very high and where land is in a river valley, then I say that it should not have rabi water unless in certain circumstances, when there is water to spare and then only very occasionally. For instance, in February this year there was a flood and a good deal of water which we could not use in any of our perennial canals and the regulating officer suggested that we should open our non-perennial canals, because we had more supply for the perennial canals than we could draw off. Water, if let down below Panjnad, would have gone waste into the sea. In such circumstances, I say that if water is available, there is no harm in giving it to any non-perennial channel for a few days during the cold weather.
57. **Chairman :** What are the views of Khairpur ?
58. **Mr. Sladen :** Khairpur State is a part of Sind. It occupies the north-east corner and just as the rest of Sind, before the Sukkur Barrage was built, it was watered by inundation canals, taking off the Indus. The heads of the two main Khairpur State canals used to take off within a mile below the site where the Sukkur Barrage has been built, and therefore it will be understood that our inundation canals were better than any other of the inundation canals in Sind. That has been admitted in the original report of the 1909 Barrage scheme.
59. There were two barrage schemes—one in 1909 and another in 1919. One of the main objects of the Sukkur Barrage was to build a big canal running down the left bank of the Indus to irrigate Nawabshah and Hyderabad Districts in British Sind. The State lies just below the Sukkur Barrage on the left bank of the Indus. That canal has to be carried through State territory. The Ruler was always opposed to any interference with his State and he held out against the construction of this canal for many years. He was eventually persuaded in 1906 to agree to its construction. One of the reasons by which they managed to persuade him was

that the State would receive a perennial supply in the same way as the rest of Sind and in the 1909 scheme he did receive a perennial supply, 4,030 cusecs throughout the kharif and 1,675 in rabi. When the new scheme was prepared during the Great War, we were again asked what we wanted and we said that we wanted a perennial supply. In the 1919 scheme, for reasons which have not been explained to Khairpur State, only kharif supply was allotted to the State. Our presumption is that the rabi supply considered available at Sukkur, was insufficient to supply more than the whole needs of British Sind and therefore they omitted Khairpur State.

60. **Mr. Nicholson :** To facilitate business, might I quote the opinion expressed by Khairpur in the 1920 Sukkur Barrage Project Volume VII, page 53. It refers to page 30 of Volume VI of the 1909 project which I have looked through and it says : " As regards the rabi season, Mr. Hill, Chief Engineer for Irrigation, in a note on the Triple project, dated 31st. January 1907, states that the Khairpur State have explained that they do not require rabi water and the nearness to the surface of the spring water level renders wells very efficient and makes rabi supply unnecessary ".
61. **Mr. Sladen :** If I might reply to that—it is an extract from a letter written by His Highness in 1906 ⁽⁶⁾ in which he objected to the whole scheme. But he was brought round with a bait that he was going to get rabi water and it was shown that it would be useful to the State.
62. **Mr. Nicholson :** Do you query the fact that the spring water level is high ?
63. **Mr. Sladen :** That applies only to part of the State. Under the new Scheme we only get kharif supply. Therefore it is not perennial supply. Since the Project was started we have been allowed, with the indulgence of the Bombay Government, a temporary rabi supply. Our claim is that we should be treated alike with British Sind and given equal rights in the Sukkur Barrage.
64. **Mr. Trench :** When was the first claim made for rabi supply ?
65. **Mr. Sladen :** On the day the announcement about the new Sukkur Scheme was published, we said we always understood that we were going to get a perennial supply.
66. According to the 1919 scheme, we were given a kharif supply of nearly 4,030 cusecs which is equivalent to our pre-Barrage supply, but as we are surrounded by districts obtaining a perennial supply, and as we feel that we have not been treated fairly by the Bombay Government in giving us only a kharif supply, we have been asking that the whole scheme should be revised. Rabi supply should be given to us either from an extra authorized supply or from the Bombay share of the withdrawals from the river.
67. **Chairman :** I take it that you wish to convert a non-perennial to a perennial irrigation area.
68. **Mr. Sladen :** The whole of Sind was non-perennial: it was inundation before the Barrage; since the Barrage was built the whole of Sind excepting a small portion is perennial.
69. **Chairman :** You are in favour of converting non-perennial into perennial ?
70. **Mr. Sladen :** We wish to get a perennial supply.
71. **Mr. Trench :** I feel that the Bombay Government is only concerned in two different aspects of the question. One is in regard to finding the water and the other is in regard to the water-logging question.
72. With regard to the question of finding the water, I am not prepared to admit that it is possible to find it from the existing supply allocated to, or withdrawn by the Barrage and that therefore, if a future supply is to be permanently given in the rabi season to the Khairpur State, it should come from the existing balances in the river.
73. The second point is in regard to the question of water-logging. The British canals in Sind are designed for the purpose of continuous running with approximately the same discharge (excluding the rice areas which receive an extra supply because they have had that supply in the past and it became virtually a prior

⁽⁶⁾ Confidential letter No. 15, dated September 6, 1906, from H. H. the Ruler of Khairpur State to Political Agent, Khairpur State. (Handed in on 4th. March 1935. See Appendix III.)

claim, or vested interest). The rice area in Khairpur State is comparatively small—I think it amounts to 6,000 acres. Beyond that the Barrage canals are supposed to run continuously with practically the same amount of water.

74. In regard to the amount of water which is given : it amounts, with the allowance for absorption, on the average to about 4·2 cusecs per thousand acres culturable commanded area at the head of the canal. The question is then, what is the position of the Government of Bombay in regard to the responsibility for water-logging in the Khairpur State ? In British India any such damage due to any action taken under the Irrigation Act, is in general not legally compensatable, but that does not apply to the Khairpur State where the Irrigation Act does not run. Consequently it has been admitted that the responsibility for water-logging due to the Rohri canal, lies on the Bombay Government. It is therefore very important from the point of view of the Bombay Government, to see that the water supply is not in excess of that necessary and does not create any undue water-logging.
75. This is our position, and it would appear that if Khairpur should get a rabi supply, total supply throughout the year should not be in excess of that given to the British canals. As I have worked out the figures, the discharge which would be given in the kharif season on the same scale as the British canals, would be about 2,500 cusecs—not more than that : that would be the maximum. That includes an allowance for the established rice area. If it is admitted in principle that the Khairpur State should receive a continuous rabi supply it would involve very heavy reduction in the kharif supply given to the same canals.
76. As regards water-logging, Mr. Sladen has said they only claim damage for water-logging due to the Rohri canal itself. I have had recent reports—we have no definite figures yet—that much of the water-logging, specially in Khairpur town itself, is far more dependent on the full supply levels in the Khairpur State canals than it is on the Rohri canal itself. That is to say the sub-soil water levels rise and fall with the rise and fall of the levels in the Khairpur State canals rather than the Rohri canal.
77. These are the only two points with which I think the Bombay Government are concerned on this issue. I am not prepared to make a statement on the matter of principle as to whether non-perennial land should receive a perennial supply or not, especially in regard to the khadir lands. For us both, Khairpur and Sind, I do not think the question can be decided on this question of principle ; it is purely a question of special cases and what is expedient in each case.
78. **Chairman :** May I ask if the land in Khairpur State is khadir land ?
79. **Mr. Trench :** We have no such thing as khadir land. The land on the river side of the river bunds is largely sailabi. The land behind the bunds is irrigable ; we do not as a rule irrigate land on the river side of the bunds.
80. There is one area in Khairpur on the river side of the bunds which has a prescriptive right to inundation canal water and water has to be supplied to it on this account. But beyond that, you may take it that the whole of the rest of the land is irrigable land. The area does not differ from the rest of Sind, and if you call it khadir land you will have to call the whole of Sind, khadir. Conditions are similar in both places.
81. **Chairman :** Is the sub-soil water table near the surface ?
82. **Mr. Sladen :** In some parts.
83. **Chairman :** Mr. Oram, do you wish to give your views on this issue ?
84. **Mr. Oram :** I consider that it is definitely wrong to provide perennial water for land likely to be water-logged. Otherwise, I think, there is nothing more to be said on the general principle.
85. It is definitely wrong in principle to give perennial irrigation to any land which is likely to be water-logged and go out of cultivation. To do so leads to infinite harm in the end.
86. **Chairman :** Mr. Foy, would you kindly give your views on the general principle ?

87. **Mr. Foy :** While I agree with Mr. Oram, Sir Bernard Darley and Mr. Nicholson that it is dangerous to give perennial water to an area in which the spring level is high, it is rather a question of defining the exact point at which the rise in spring level becomes a danger to the country. For that reason I would suggest that the practical definition of non-perennial land is land in which wells can be worked economically—the ordinary open masonry-work well. For these areas, perennial water should generally speaking, not be given at all, or given on a very restricted basis.
88. One point further which I would like to make is the question* Mr. Sladen raised with regard to upsetting colonization. This is a very serious matter and surely it is better to face the situation at the stage to which colonization has now advanced, than when colonization will be fully developed if the land is going to be water-logged. I do not say that non-perennial areas should receive no rabi water, but it must be very strictly limited if the dangers of water-logging are to be avoided.
89. **Mr. Nicholson :** As regards the areas considered by Bahawalpur to be khadir areas, reference may be made to the 1920 Sutlej Valley Project, Part II, page 7, and appendices L. 1-3, F. and G. in which the areas considered as khadir are given in detail, sheet by sheet as delineated on the maps in the portfolio.
90. Rabi supplies which have been enjoyed by Khairpur State canals are recorded in Volume II, Sukkur Project, 1919, Appendix M, pages 254—259, and the supplies which have been allotted to Khairpur are given in Volume V, pages 10 and 11, Statements VII and VIII. It may be noticed therein that the supply is not only allotted during the kharif season, but 3,000 cusecs are allotted in October, November and December, which is the rabi period, which has possibly led to a certain amount of misunderstanding in regard to the question of perennial supply. It follows that it is not kharif supply alone that they are given, but they are given a supply in rabi, which amounts almost to a perennial supply, even if not 100% perennial.
91. It may be noticed that in the pre-Barrage times they enjoyed an average in October of 332 cusecs and in November, of 45 cusecs, whereas now from the Khairpur canal they have been allotted 3,000 in these months, and from the Khairpur outlets from the Eastern Nara, 400 cusecs from April to September.
92. If you will turn to Volume VII, page 57, paragraph 220 you will read :—“ In the case of Khairpur State, the area on which its share of the Barrage has been calculated has been taken as the Kharif cultivation only, no charge being made for the very valuable bosi (?) rabi which is allowed for ”. That is what has been accepted by the Secretary of State.
93. It would appear from what Mr. Trench has said that, to convert Khairpur canals into a full perennial system would amount to these canals becoming a new project, and that they will have to come in with other claimants for a share in the surplus water which may be available after satisfying existing projects.
94. **Mr. Trench :** The question of whether an additional supply of water comes under the term “ new project ” or “ existing project ” is a question of whether the new supply of water is designed to afford an adequate return on existing capital sunk or on new capital proposed to be sunk in the work.
95. **Mr. Nicholson :** I take it therefore, that you consider the financial outlook as of paramount importance, and the best use of water for the country at large becomes subordinate.
96. **Mr. Trench :** Both are intimately bound up.
97. **Mr. Nicholson :** Part XI, Volume VII of the Sukkur Barrage Report contains essential matters of fact which will help the Committee to come to a definite decision.
98. **Mr. Sladen :** In regard to the supply allotted to the State in November and December, it would be practically useless to us, since our soil is not suitable for bosi and no wheat can be grown without water in the maturing season.
99. *The Chairman enquired if any other member desired to speak on this issue. On receiving a negative reply, he said that he and his colleague felt fully instructed on the point and that he proposed an adjournment of one hour for luncheon.*

100. *The Committee re-assembled after lunch and proceeded to discuss ISSUE No. 2.*
101. **Mr. Sladen:** We have two canals, the East feeder and the West feeder. The gross area commanded by the East feeder is 470,000 acres; and in the case of the West feeder, 273,000 acres in Khairpur and 21,000 in British enclaves, total 764,000 acres. Of that gross area, the culturable irrigable area is 320,000 acres on East feeder, 260,000 acres on West feeder and 20,000 acres in British enclaves. These figures of culturable area are taken from survey village maps. The total is 600,000 acres.
102. We claim to be allowed to participate equally with the British Sukkur Barrage where the intensity is 27% in kharif and 54% in rabi. On that basis, the area proposed to be irrigated is 86,400 acres on East feeder, in kharif, and 70,200 on West feeder, in kharif, and 5,400 on enclaves, also kharif. With regard to the rabi area that on East feeder is 172,800, on West feeder 140,400, and in the British enclaves 10,800 acres respectively. The British enclaves are also dependent on the West feeder.
103. In addition the Ruler has about 40,000 acres for shikar-gahs. The Ruler is very keen on shooting and considers it almost as important as cultivation and has pressed for a water supply for shikar-gahs. At present they take water in kharif and rabi. I don't propose to ask for a supply for these shikar-gahs, but to ask for a concession on the duty. As I am the representative of the State here, I should like to press that point.
104. **Chairman:** May I ask if these areas are accepted as fairly reasonable?
105. **Mr. Foy:** We are hardly in a position to contradict if we wanted to.
106. **Mr. Sladen:** In the 1919 Project, the kharif intensity was shown as just about 33 per cent. but later in the Project they said that Khairpur State ought to work on the same duties as British India.
107. **Chairman (to Mr. Trench):** You support the Khairpur claim in your BRIEF?
108. **Mr. Trench:** If the additional rabi water is given, then the intensities will have to be adjusted, i.e., the present proposed kharif intensity should not be maintained.
109. **Mr. Sladen:** If the rabi water is given, I am agreeable to reduce the intensity in kharif to this figure.
110. **Mr. Nicholson:** I would like to ask if he should not deduct the area that is water-logged?
111. **Mr. Sladen:** I am willing to consider some deductions if they are found necessary.
112. **Chairman:** Do your commanded areas include the water-logged areas?
113. **Mr. Sladen:** Yes. The water-logged area amounts to an area of about 30 square miles at present.
114. **Chairman:** Do you agree to modify your commanded areas by deducting those areas which it is anticipated may be water-logged?
115. **Mr. Sladen:** It is rather a big question. Of course, water-logging is increasing, but certainly I do not wish to put irrigation water on water-logged land.
116. **Chairman:** Anyway, you will detect it and find out the dangerous area.
117. **Mr. Sladen:** If the land is water-logged it cannot be avoided, but I do not wish to increase it.
118. **Mr. Betterton:** Is the water-logged area increasing?
119. **Mr. Sladen:** Slightly increasing as a result of seepage from the Robri Canal. A number of pumping stations have been erected near the Rohri Canal.
120. **Chairman:** Let us now hear Mr. Trench's figures.
121. **Mr. Trench:** I am afraid I have not got complete figures in every respect, especially in regard to the culturable area of rice which has been treated rather differently.
122. *Mr. Trench quoted figures of gross area, culturable commanded area and also rice area in respect of the Rohri Canal, the Eastern Nara Canal, the North Western Canal, the Rice Canal and the Dadu Canal.*

123. In the Rice Canal there is also the question of the second or dubari crop as to whether it should be included in the area to be irrigated or not. It is not irrigated during the rabi season. The Rice Canal is an entirely non-perennial canal. It is open normally from the 15th. April. At present it is opened somewhat later because cultivators have not become accustomed to early sowing. It is open till 15th. October. The Manchur Drainage Scheme is referred to, in one of the statements attached to the Sind BRIEF. It is a scheme in which the flood water is drained off for rabi irrigation. It is not canal irrigation and therefore need not be considered.
124. **Chairman :** We are not really concerned with this.
125. **Mr. Nicholson :** Is this water, drainage, from the hills ?
126. **Mr. Trench :** Yes. It does not affect the canal supply.
127. **Chairman :** How do the figures compare with the project ?
128. **Mr. Trench :** They are much the same. They vary slightly. They are compiled from the last financial forecast statements.
129. **Chairman :** The total will not be affected.
130. **Mr. Trench :** No. Not appreciably. There may be certain differences as certain areas have been transferred between the canals since the project.
131. **Chairman :** Will you kindly let us have all the figures in the form of a statement ?
132. **Mr. Trench :** Yes.
133. **Mr. Nicholson :** As regards the figures of the Eastern Nara. The gross area commanded is 2,165,000 acres and the culturable commanded area is 2,091,000. This is 97 %. It seems to be a very high percentage.
134. **Mr. Trench :** Yes—it is extremely high.
135. **Chairman :** Any comments about the intensity ?
136. **Mr. Nicholson :** The intensity is very high but I have no desire to disturb the existing arrangements.
137. **Chairman :** Sir Bernard Darley will give his views.
138. **Sir Bernard Darley :** I have given the statement asked for in regard to the canals from the Sutlej. There is one point I would like to know. How far is it usual to include lift areas in the culturable commanded area ?
139. **Mr. Sladen :** We include lift areas.
140. **Sir Bernard Darley :** Every one knows that the Sutlej Valley Project was based on the area within irrigation limits whether commanded or culturable. The figures which we give now for gross and culturable commanded areas are the actual figures after deducting every acre which is not commanded by flow irrigation.
141. The Sutlej Valley Committee, because water was so short, based their recommendations on the "allottable" area, and we have given the areas recommended by them. There is no demand at present for lift areas and these are not allottable. Our gross area does not include any lift area whatsoever. The whole area was examined acre by acre, first of all by a civil officer, Mr. Mackeowen, who had done similar work in Nili Bar. Afterwards his papers were checked by the Committee who called in Dr. McKenzie-Taylor and he verified all doubtful areas by taking soil samples from different spots. So our culturable commanded area is really the allottable area, that is excluding all lift areas. It is thus a very low figure compared with others. They have apparently done the same thing in British India. They have taken out the figures of culturable commanded and the allottable area. For instance on the Pakpattan Canal, according to the Colonies Report for 1932-33 the culturable irrigable waste is 739,000 acres and the allottable waste is 663,000 acres.
142. In that Report it is stated—"No less than 872 rectangles, making up 28 complete colony estates, were exchanged for better land during the year. The Colonization Officer anticipates that approximately 500 rectangles will still have to be exchanged. It is unfortunate that exchanges on such a scale have been necessary. The result is to lessen the value of the land left available eventually for sale by auction The fact appears to be that the colony, especially

in the Lodhran tahsil and in the western portion of the Western Mailsi tahsil contains much more poor land than was anticipated and exchange was the only remedy if wholesale desertion by the colonists was to be avoided ”.

143. In other words the allottable area in the Punjab has been cut down on account of bad land, just as has been done in Bahawalpur. Our figures for culturable commanded area cannot be compared with the culturable commanded area elsewhere. It is a lower figure. I mention this particularly now, because the Members of this Committee may have formed a different opinion from the Bikaner BRIEF. I take it, however, that we are only concerned with the Panjnad and the new Abbasia areas.
144. The spring level over most of the new perennial area on the Panjnad varies from about 20' to 30' and it is anticipated that there will be no water-logging. I have compared the figures now proposed with those of the revised project. It was impossible to compare them canal by canal with those of the 1920 Project, because there was no mention of the Eastern Canal in connection with Bahawalpur. Also the weir proposed at Jamlera was moved down to Islam thus upsetting the balance of areas.
145. **Chairman :** We have got figures for the revised project. How do your final figures compare with the 1920 Project ?
146. **Sir Bernard Darley :** I will read them out. The figures are only given by weirs in the statement accompanying the Project report.
147. **Chairman :** The gross commanded areas in the original project were really approximations. Large areas were left out. What about the intensities in the original project ?
148. **Sir Bernard Darley :** That proposed for Bahawalpur from Sulemanki weir was 62·6% for perennial and 50% for the non-perennial canals, of the area within irrigation limits. From the Jamlera Weir, 66·2% perennial and 50% for the non-perennial. On the Panjnad, 55·7% perennial and 60% for the non-perennial channels.
149. **Chairman :** The intensity should be increased ?
150. **Sir Bernard Darley :** The intensity would increase on the culturable areas. Those percentages are on the gross area.
151. **Chairman :** Mr. Nicholson, have you anything to say ?
152. **Mr. Nicholson :** This statement is rather a difficult one to criticize in full detail at first glance as it has only now been put forward. There is one point of which I do not know if Sir Bernard Darley appreciates the full purport. He has wiped off the Abbasia as a perennial canal and has put in the Panjnad as a perennial canal. A non-perennial canal under the terms of the Agreement cannot run as a perennial canal, and in the report of the Sutlej Valley Project Enquiry Committee, Bahawalpur of 1932, it was stated that the perennial area should be fed through the Abbasia and not through the Panjnad. Now he is going against the Sutlej Valley Enquiry Committee.
153. If you turn to page 19, paragraph 62, of that Report, he starts off : “ The area commanded by the Panjnad Canal is probably the best land in the State. Several large inundation canals from the Panjnad and Indus rivers have irrigated this country so far, and during July and August each year large volumes of water were poured on the low lying portions of the country North of the railway. Spring level is thus high in parts, often only a few feet below the surface after the rains. With the introduction of a controlled supply matters should improve, because although more water will be given in April, May and the first half of October than formerly, this water will be distributed evenly.”
154. Now comes the important part. “ It would, however, be dangerous to give perennial irrigation to the area south of the railway through this canal, as has been suggested, and this is why the new feeder line from Abbasia has been proposed.” Now the tables are turned. That is to say it is being fed through the non-perennial channel.
155. The situation has become even more complex. In the “ Civil and Military Gazette ” of the 2nd. February 1935 it is advertised : “ Perennial lands for disposal on the Panjnad canal ” which is a non-perennial canal. Sir Bernard Darley may possibly be able to clarify the situation.

156. **Sir Bernard Darley :** The Abbasia is a high level canal and it runs almost parallel to the Panjnad canal for a long distance, as you will see from the map. Mr. Cox, Superintending Engineer, III Bahawalpur Circle, pointed out that if we ran this water down a high level canal, we might indeed cause more water-logging than a low level channel. The Panjnad canal runs for some distance below country level, and therefore there might be more intensive water-logging by running it in the high level rather than in the low level canal. He further pointed out that some lakhs of rupees would be saved, as we would not have to maintain some 30 miles of the Abbasia canal if we ran the supply down the Panjnad and down the Minchin Branch.
157. We had a meeting with Mr. Cox and the other Punjab Engineers who were there at the time, and on his recommendation we decided to save the extra money and ran the water down the Panjnad canal. We explained the whole thing in a letter to the Chief Engineer, Punjab, and asked him if they had any objection to our using the non-perennial canal. He said they had no objection and we proceeded accordingly.
158. **Mr. Nicholson :** When it comes to running a mean supply for the rabi of 516 cusecs in a canal of 9,567 cusecs capacity, it is rather doubtful what efficiency you can get from the water you put in, even if it were permissible under the Agreement.
159. **Sir Bernard Darley :** Our losses at present are not heavy in the main canal: they are more in the Minchin Branch. As for taking water into a non-perennial area, Bahawalpur was assured from the very first that it could utilize its share of the water where it pleased.
160. **Mr. Nicholson :** But a very distinct restriction was put upon the fact that the non-perennial canals would be closed during the rabi season.
161. **Sir Bernard Darley :** But the Punjab Government agreed.
162. *Mr. Nicholson asked for the reference and further general discussion followed which was not recorded.*
163. **Mr. Foy :** May I ask Sir Bernard Darley whether these figures of culturable commanded area correspond with the figures quoted in the Sutlej Valley Report ?
164. **Sir Bernard Darley :** Everywhere, except in the Panjnad area where, after the Committee reported, Dr. McKenzie-Taylor was called in to do a soil survey. The figures were altered slightly in consequence of his report.
165. **Mr. Foy :** May a copy of the report be placed on the table ? The Sutlej Valley Committee's report—Bahawalpur portion. I haven't had a copy.
166. *This was done.*
167. **Sir Bernard Darley :** Dr. McKenzie-Taylor came down afterwards to determine what areas were allottable and what were not allottable. He did the survey after the report was written.
168. **Mr. Foy :** There is one point before we come down to the areas mentioned in the report and that is this question of 80% intensity in this area: that is definitely contrary to the Tripartite Agreement.
169. **Sir Bernard Darley :** 80% of what ?
170. **Mr. Foy :** Of your culturable commanded area.
171. **Sir Bernard Darley :** There is no mention of culturable commanded area in the Agreement. The Agreement is based on gross area within irrigation limits.
172. **Mr. Foy :** There are two points. The gross areas are not the same as the gross areas on which the Agreement is based. You are framing a project entirely different to the one on which the Agreement was based. This is one point, and the other point is that the intensity, that is to say the actual proposed irrigation, has increased. These two points contravene the Agreement.
173. **Chairman :** The parties can utilize their share of water as they like.
174. **Mr. Foy :** It does not say that they can definitely divert perennial water on to non-perennial lands.
175. **Chairman :** This is a different point.

176. **Mr. Foy :** The relevant paragraph is a footnote to paragraph 4. C. of the Sutlej Valley Project Report, 1920. "The average perennial supply available will be allotted entirely to the perennial channels from the 15th. October up to 31st. March and the non-perennial channels will be shut down on the 15th. October". It appears that if water is allotted to a perennial canal and you say that the non-perennial canal will not receive water during such and such periods, you imply that the non-perennial land will also not receive water during those periods.
177. **Sir Bernard Darley :** Even the letter* to the Secretary of State says : "The general principle underlying the Agreement is that the water of the two rivers shall be divided between the parties in certain fixed proportions, each party being free to utilize its share as it considered best and no restriction being placed on the area of the land to be irrigated from it".
178. **Mr. Foy :** Again, may I refer to the Agreement. There you have a very marked differentiation between the khadir areas which are non-perennial areas and the perennial areas, and diversion from one to the other is definitely a breach of the agreement.
179. *Sir Bernard Darley quoted Part II of the Sutlej Valley Project, 1920 page 1 of Mr. Nicholson's report on which general discussion followed, which was not recorded.*
180. **Mr. Trench :** There is one question I would like to ask about the Agreement. The first sentence—"The project should be drawn out under the exclusive control of Government". Does not this imply that the project had not already been drawn out before, and that therefore the final arrangement of where and how water should be used had not been settled ?
181. **Chairman :** The Agreement does not come under our terms of reference.
182. **Mr. Foy :** May I suggest that within the present terms of reference, it is impossible to make any recommendations which are likely to be acceptable to the parties concerned.
183. **Sir Bernard Darley :** Are Bikaner concerned in the questions referred to the Committee ?
184. **Mr. Foy :** As a party to the Tripartite Agreement, I am given to understand, that they are concerned.
185. **Sir Bernard Darley :** One of the things I was going to suggest, if the Agreement came up, was that this clause 4. D. 2. should be deleted under the orders of the Governor General in Council. This could be done under clause 31 of the Agreement and Bikaner would have to justify any objection on their part.
186. **Mr. Foy :** You may be right, but as practical men, if it is possible to come to some conclusion which would be acceptable to all parties, it would be a much more practical proposition than the one which, as you know, is going to involve years of litigation.
187. *General discussion followed, which was not recorded.*
188. **Mr. Foy :** The allowance of 80% for the new Abbasia area is a separate project. If regarded as a part of the original project, it contravenes the Tripartite Agreement of 4th. September 1920. The Fordwah Canal is shown as having a gross area of 450,000 acres in the Sutlej Valley Project Enquiry Committee, Bahawalpur Report. The revised figure of the gross area is 447,000, a reduction of 3,000 acres. If you look at the end, you will see that in addition, the rabi area on the Fordwah Canal will be irrigated by the Sadiqia Canal if the new feeders to the Bahawal Canal are built. This area is included in the Sadiqia area above ?
189. **Sir Bernard Darley :** I will look into it.
190. **Mr. Foy :** The third point is this—see page 20 of the same Report. It is stated that of the total, there is a certain amount of area amounting to 117,744 acres on the Gharra reach of the Sutlej river which is called "poor land" which may be taken up ultimately.
191. **Sir Bernard Darley :** It is being taken up very quickly on special terms for inferior land.
192. **Mr. Foy :** It is a financial proposition ?

*Despatch No. 15 P. W. of 17th March, 1921, para. 16.

193. **Mr. Oram :** - Looking into these figures it seems to me that the total perennial area shown under the revised estimate for the Sutlej Valley Project of 1926 is greater than the total area now proposed, and the non-perennial area now proposed is very much less than stated in the revised estimate. Ignoring for the moment how the change of areas from perennial to non-perennial conflicts with the Agreement, the total areas are now less than those in the revised estimate. The question of conflict with the Agreement has already been discussed by Mr. Nicholson and others.
194. **Sir Bernard Darley :** What has happened is this. The Sutlej Valley Project Committee went over the areas in 1932 when there was a great shortage of water, and they said that we ought to cut down areas as far as we could. That was why lift areas were left out. Originally the Punjab engineers differentiated between lift and uncommanded areas. When the lift was low they included it but the Sutlej Valley Project Committee left these areas out.
195. Last year we had a very good supply in the early portion of the year. We sowed an enormous area. Our colony area went up by 120,000 acres. The result was that it was difficult to mature when the river supply dropped to a very low figure. We had to give remissions over 30% of our rabi perennial area because we received insufficient water when we needed it most, although the average worked out all right.
196. In 1931-32 we had the worst year on record. We lost 37% of our rabi crop for want of water. Therefore it was decided that we must cut down areas and our culturable area has been cut down as far as possible.
197. The intensity of 82% was fixed by the Punjab engineers before they handed over to us. The Committee put it at 80%. The purchasers purchased their lands on that basis thinking that because the Punjab officers had built the canals for this intensity, water would be given for this percentage.
198. We followed the same procedure in the Panjnad area. The soil survey was being done while the Committee were making their report. As a result the culturable area has been cut down there also.
199. **Mr. Nicholson** (*pointing to certain areas on the map of the Eastern Sadiqua canal*). They are hardly economically irrigable.
200. **Sir Bernard Darley :** Then canals should not have been built there.
201. **Mr. Nicholson :** When you show Fordwah canal in this statement ⁽⁸⁾ as non-perennial, why did you advertise land on its distributaries as perennially irrigated. This statement put in by Sir Bernard Darley is incorrect.
202. **Chairman :** I will now ask Mr. Foy for his statement of areas.
203. **Mr. Foy :** My figures have been arrived at very carefully. The total area for which canals have been constructed as given in the BRIEF is 650,000 acres. Actually since writing the BRIEF, I have gone over all the areas in order to see that there is no possibility of error. The actual area for which canals have been constructed amounts to 664,000 acres. These are all perennial areas. The gross area within chak limits comes to 758,506 acres. In addition to this area there are about 200,000 acres for which canals can easily be constructed, of which 94,000 are easily commanded and of good soil.
204. The area in the revised project of 1926 is 755,000 acres as against 758,000 in the Panjnad area.
The culturable area is not given in the revised project.
These figures I have taken from the original project.
205. **Chairman :** In the 1920 Sutlej Valley Project the annual irrigation comes to 337,000 acres and the annual irrigation proposed is 447,000—an increase of 40%.
206. **Mr. Foy :** The reason for that will be found in the 1926 revised estimate, which has been accepted by the Secretary of State. The original gross area in the 1920 Project was 540,000 acres. This was increased to 755,000 with the concurrence of the Secretary of State. Savings are due to reduction of absorption losses on the main canals and branches which do not come up to project reservations for absorption.

(8) Statement of Areas of Bahawalpur canals-tabled by Sir Bernard Darley, Appendix IV D.

207. **Chairman :** May I explain that all the information we are asking for regarding areas and intensities, is required to enable us to report to the Government of India. We are trying to get the general opinion of the members of the Committee with regard to the reasonableness of these areas and also intensities.
208. (to Mr. Foy) : You have shown in your statement 135,000 acres as irrigable for kharif and 200,000 as irrigable for rabi. Where have those figures come from ?
209. **Mr. Foy :** The intensity was also put in the Agreement. The 1920 Project increased the gross area to 540,000. The 1926 revised estimate increased it to 755,000 acres.
210. **Chairman :** In which project are those intensities to be found ?
211. **Mr. Foy :** They are to be found in the Agreement. The 156,000 acres and 312,000 acres are the figures we proposed in the Bikaner BRIEF.
212. **Chairman :** How did you get those figures ?
213. **Mr. Foy :** For the rabi and for the kharif the actual average supplies available over 15 years were worked out. Utilizing the actual figures of discharges and irrigation of the Lower Bari Doab Canal, which is the least developed of the Punjab Canals, the result of using those figures was a most conservative one. The facts are stated in the Bikaner BRIEF, para. 42. It is shown that if those mean supplies, available on the Sutlej Reach were utilized with the same efficiency as on the Lower Doab Canal, the average intensity of 79% on all perennial areas would be obtained. The culturable commanded land on the perennial portion of the Sutlej project is assumed in this BRIEF ⁽⁹⁾ to be 2,350,000 acres. There is sufficient water to mature an intensity of 79 per cent. of that cultivable commanded area.
214. **Chairman :** In other words, the intensity you have assumed for your figures is a variation from the project.
215. **Mr. Foy :** It is a variation from the project.
216. **Chairman :** And as a result of those figures and duties which will be discussed later, do you propose any change in discharge ?
217. **Mr. Foy :** I do.
218. **Chairman :** When the question of duties comes up, you will suggest a modification of the duties in your favour ?
219. **Mr. Foy :** I will.
220. **Mr. Nicholson :** Could you bring it on the record that the advertisement in the " Civil and Military Gazette ", with relation to perennial land was incorrect ?
221. **Sir Bernard Darley :** Due to the recommendation of the Sutlej Valley Committee, 12,000 acres of State waste land at the tail of the Fordwah canal, are now being fed with rabi water from the feeder canal which now supplies a portion of the perennial water to the Bahawal Canal. This is the area referred to in the " Civil and Military Gazette " dated the 2nd. February 1935, as being perennial irrigation.
222. **Chairman :** Will Mr. Nicholson please state his areas for the Punjab.
223. **Mr. Nicholson :** I table a tracing of the Thal Patti Project ⁽¹⁰⁾.
224. Originally the Thal project contemplated irrigating the whole of the area shown within that chain dotted line, two projects had been prepared : one for a canal capacity of 16,206 cusecs and another for a canal of 14,000 cusecs capacity. Then there was a lesser Thal project put up, which comprised the area to the west between the chain dotted line and centre dotted line. That was the lesser Thal Project, put up after the major one in the hope that when the lesser was constructed, then the large one would come in and take over the whole of that area which has now been admitted to be, to a great extent, unirrigable.
225. Subsequent to this the question of the Sind-Sagar Colonization Act came up for consideration and Government considered the whole question of the Thal and found that it was desirable to repeal the Act, which was done.
226. This project which you now see before you is the lesser Thal Patti Project prepared by the Superintending Engineer who was in charge of survey of the Thal and prepared the major projects. The major project he considered an impracticable one and he put forward this one as being the only one which would ensure success. It was, however, side-tracked and put away, but when the

(⁹) Vol. II.

(¹⁰) On record in Central Board of Irrigation office. (P. 1).

question of the repeal of the Sind-Sagar Act was taken into consideration it was found to be the best solution of the problem. The Punjab have as a matter of conciliation agreed to remove the terror hanging over the head of Sind of a canal of 16,000 cusecs capacity. This project as you will see from the map, includes only those areas which are really economically and efficiently irrigable and for this a canal of a head capacity of 6,000 cusecs is asked for.

227. The gross area is 1,500,000 acres, of which 85 per cent. is taken in the normal way as being culturable. We are taking the same water allowance of 4.0 cusecs capacity at Canal head per thousand acres gross. I trust that Sind will see that we are doing all we can to alleviate their fears.
228. **Mr. Trench :** I am not prepared to criticize Mr. Nicholson's figures with regard to areas and percentages. I think they are most economical percentages for these particular areas. In saying that, of course I reserve the right to criticize the question of whether these projects should be proceeded with or not, but that is not the point at issue at present.
229. *The Chairman adjourned the meeting at 5-0 p. m.*
230. *The Committee re-assembled at 9-30 a. m. on the 2nd. March 1935.*
231. **Chairman :** Mr. Oram will kindly give us figures about the Paharpur Canal if he has them, as we want them for record.
232. **Mr. Oram :** I will give those figures now. I have not got the actual project with me, but from the file I have here I can give the figures as they are required.
233. The original project—Paharpur Canal—was sanctioned in 1905 and it is not specified whether it was sanctioned as a perennial or non-perennial canal. It was designed for a "normal discharge", which is not specified as average nor mean, of 604 cusecs, and for a maximum discharge of 1,100 cusecs. It was run as a perennial canal in 1908-09, 1912-13, 1930-31 and 1931-32.
234. The remodelling and extension scheme was made out in 1931-32, and it contemplates a maximum kharif discharge of 875 cusecs and rabi of 500 cusecs. That includes an extension beyond the Dehra Ghazi border and it is a question whether the Punjab would like to extend it into Dehra Ghazi Khan district. The mean discharge is calculated at 700 cusecs kharif and 360 cusecs rabi as against the normal 604 in the original project. The present canal is now being provided with a means of assuring the supply of the discharges required at the moment, pending the extension being undertaken. The discharges required at present are 500 cusecs kharif and 250 cusecs rabi.
235. As regards areas, I have not yet got the gross area of the main project, but 85 per cent. of the gross area is taken as the culturable commanded area which is 142,000 acres and these discharges are based on the assumption of a kharif: rabi ratio of 2 : 3, a full supply factor of 77.5 acres per cusec kharif *plus* 20 per cent. absorption and 205 in rabi with the same absorption. I am speaking from memory.
236. The present small project is for the old canal only and how these smaller discharges have been arrived at, I cannot say, as I have no figures. There are various other aspects, which perhaps it would be better to discuss under the issue concerned with discharges.
237. **Mr. Nicholson :** You could describe it as a semi-perennial canal.
238. **Mr. Oram :** I would put it as a perennial canal and it has been used as such whenever possible.
239. **Mr. Nicholson :** About its extension to Dehra Ghazi border ! Do your present figures include any such extension ?
240. **Mr. Oram :** If the Punjab are willing to extend it, provision for extension has been made in the figures given. The main remodelling and extension scheme has been postponed pending the existing canal receiving an assured supply.
241. **Chairman :** Let us go on to ISSUE NO. 3 and to save time, let us also discuss the question of the relationship between rabi and kharif irrigation, namely, should it be 1 to 1, 1 to 1½ or 1 to 2. Mr. Nicholson will open the discussion.

- 242.** Mr. Nicholson : I think the finest note on this subject is that by Mr. Gibb on pages 61 to 65 of the 1917 Sutlej Valley Project. He goes into it in great detail. I do not want to quote from it but I think I have it fairly well in my mind. In *figure I* he shows the nature of the supplies during the 'rabi to each of the canal systems. In *figure II* he shows the average supplies which can be drawn by a canal from a river with a discharge as shown in the dotted curve. In *figure III* he shows the relation between intensity of kharif irrigation on the gross area and the kharif duty which, as he points out in his note, is a function of the full supply of the canal and not the water run in the canal : that is to say, the irrigation in the kharif depends, not upon the water utilized but upon the head capacity of the channel, that is the ability of the channel to supply water at the time of maximum demand.
- 243.** In this case going up to a percentage of 35 in the kharif area on the gross area, the efficiency steadily increased and has not reached the limit. In *figure IV* he shows the relation of the rabi duty to the percentage of irrigation on gross area. In this case the rabi duty is a function of the mean discharge run in the canal. Here it is noticed that the curve ascends to a maximum and then falls off, the maximum efficiency comes between the rabi intensity of 45% and 50% on the gross area. In the United States of America, they consider that the Punjab practice is one to be commended in so much as the water supply given to cultivators at the outset is not too generous and a low intensity is aimed at. When the cultivators become more accustomed to the use of water, they have the incentive to be more efficient inasmuch as their personal efficiency reaps the reward of a greater out-turn of matured crop from their water.
- 244.** In the United States, water allowance is given, where it is considered to be required, for the irrigation of the whole of their area. The result is that they have incentive to increase their efficiency and the same amount of water is slopped on to the land and water-logging ensues. But they will not agree to any reduction of supply to make extension of irrigation possible elsewhere, with the water saved.
- 245.** I have here hydrographs⁽¹¹⁾ of the mean discharges of the Punjab rivers where they leave the hills for the various months over a period of twelve years prior to 1932-33. In the case of Kalabagh on the Indus there is a line drawn showing the rabi capacity of the Sukkur canals from which you will see that the supply falls but little below the capacity in the months of December, January and February.
- 246.** Again, on another graph showing the mean discharge of the Chenab, Jhelum and Ravi, all combined over a period of 12 years, the total rabi withdrawal of the Punjab canals taking off therefrom is shown, and it will be noticed that there is a marked trough in the period from the middle of October to the beginning of March. Then there is the Sutlej and Beas diagram ; in this case it will be noticed that the trough is over a very much longer period. All these diagrams are based on the mean ten-daily discharges over a period commencing from 1922 onwards and a statement in blue print form is put up⁽¹²⁾ showing the figures from which these diagrams were compiled.
- 247.** As regards the full supply factors for the kharif, and the rabi duties which have been adopted for the Sutlej Valley Project, it is unnecessary to say anything further as the whole matter has been dealt with *in extenso*, by Sir Thomas Ward, the late Inspector-General of Irrigation in his note, dated the 3rd. December, 1919, on the Sutlej Valley Project. The kharif full supply factor adopted in the canals is 70 and for the rabi a duty of 210 on the mean supply at distributary heads. To convert these to figures for canal head, 20 per cent. absorption was accepted as being the fair average which covers the worst conditions. From these, the figures for duties and full supply factor for canal head will be 5/6ths of those at the distributary head.
- 248.** Two statements are put in,⁽¹³⁾ showing in abstract form the data recorded in the blue book "Statistics of Irrigation Water Distribution and Working of Distributaries of the canals in the Punjab", the latest publication 1932-33, both for the old canals and for the Sutlej Valley Project.

(11) Plate V.

(12) Appendix V.

(13) Appendix II, (A) and (B).

These are for one year only and show, for the first time in the publication, complete separation of the data for perennial and non-perennial channels. From these, have been worked out the absorptions deduced therefrom. That an allowance of 20 per cent. for absorption was sufficient, as adopted in 1920, is substantiated by the fact that in the 1926 revised Sutlej Valley Project estimate, it was found that the absorption losses were less than 20 per cent. assumed which left more water available for irrigation.

249. The kharif full supply factor for the Sirhind Canal for the year 1932-33 of 118 may be compared with similar figures for two quinquennial periods 1905-10 and 1910-15 in which periods these were 58 and 63 respectively, as recorded in Project Volume I, page 55. Bhakra Dam Project. It will thus be seen how enormously the efficiency of this canal for irrigation has developed from 1915 to 1932. The full supply factor in the kharif in the year 1932-33 of the Western Jumna Canal was 58 as compared with the same quinquennial of 70 and 66. This is very much lower, but it may be noted from column 18 of the statement that the capacity factor of this canal was 0.37, which shows in other words that the canal, owing to low supply in the Jumna river, was running about one-third full supply, for the mean of the whole crop.

250. Turning to the rabi duties given in the blue print, ⁽¹⁴⁾ you will notice that the Sirhind Perennial is 237, the Upper Bari Doab Perennial 329, the Upper Jhelum Canal 232, the Lower Jhelum Canal 230, the Upper Chenab 197. The last is low because of high spring level, water-logging and many adverse conditions. The Lower Chenab Canal is 249, and the Lower Bari Doab Canal is 181. The Lower Bari Doab, 181, is low because of heavy overlapping between cotton in kharif and the rabi sowing periods, that is, a small area of rabi crop is put down with the result that an excess of supply above what is required is given during the maturing period. The most advantageous use of the water, is to run the canal full supply during the sowing period, October and November. With the area of crop put down the zemindar unwillingly complies with the law of supply and demand and utilizes the water for maturing at its highest efficiency. So far, these figures have been for the old canals. An inspection of the statement of the Sutlej Valley Project ⁽¹⁵⁾ shows a very different state of affairs.

251. There is one other point, that is kharif to rabi ratio. In the old days a canal system was *designed* for a kharif to rabi ratio. This ratio entirely depends on the nature of supplies available in the two crops and the predilections of the cultivators for various forms of cropping. For instance the Lower Bari Doab Canal was designed for 1 : 1 crop ratio and is now running to 1 : 1.6 although in the meantime Government has decided to change it over from 1 : 1 to 1 : 1.25. The Sirhind Canal was designed for 1 : 2 ratio and was running as such in the decennial period 1905-15, whereas in 1932, the ratio has become 1 : 1.6.

252. In the decennial period referred to, on the Sirhind Canal the zemindar considered it was not worth while to put down kharif crops to any extent other than fodder crops for their cattle as it entailed what they considered to be hard work under arduous conditions and all endeavours to develop kharif irrigation were without avail. During the boom after the war, however, they found they could make money out of their kharif crops which enabled them to live in a better style although they got less leisure. In other words, there was an increase in the standard of living.

253. This shows how fallacious it is to endeavour to lay down what the crop ratio will be, by any authority, as it will develop according to the needs of the time and current market prices.

254. Regarding the effect of rainfall on various tracts, people go by their own personal experience. But there may be conditions which are not normal. As an independent record, the Climatological Atlas of India published by the Indian Meteorological Department, 1906, Plate 114, shows the normal rainfall of the year, from which it will be seen that from Montgomery down to Hyderabad there

⁽¹⁴⁾ Appendix II, (A).

⁽¹⁵⁾ Appendix II, (B).

is a small rainfall range and it is all below 10" with the exception of the small area centering on Jacobabad where it is as low as 5" or 6".

- 255.** It may be noticed that in the lower portion of the Punjab the conditions experienced are similar to those in Bahawalpur, so that there is an entire sympathy amongst Punjab officers for the conditions in Bahawalpur which are said to be so arduous, of which they are so fully aware in portions of the Punjab itself.
- 256.** Plate 115 shows the conditions of seasonal rainfall in January and February. Here it will be noticed that the conditions are far more uniform for all parties, from Sirsa to Jacobabad and Karachi and as far north as Montgomery and Dehra Ismail Khan. The normal is 1" for the period. The shape of the annual rainfall isohyets, it will be seen, is controlled by the rainfall from June to October. In the period, November to February, during the rabi, when supply is short, rainfall also is very small for all parties.
- 257.** As regards the rainfall on the upper reaches of the Punjab canals, a large area has been converted from perennial to non-perennial irrigation as may be seen from an inspection of the general map of the Punjab.
- 258.** *Mr. Nicholson pointed out on the Punjab Irrigation Branch general map that certain areas had been converted from perennial to non-perennial due to a rise in the sub-soil water table.*
- 259.** It has been mentioned that the number of rainfall stations is few, and may cause erroneous conclusions to be arrived at. A copy of the map ⁽¹⁶⁾ supplied by the Secretary of the Committee is put forward showing the details of rainfall at certain rainfall stations.
- 260.** *The latest records of the Meteorological Department published since the Atlas was produced and all the rainfall records which are printed up in the Blue Book statistics referred to previously, were examined by the Committee.*
- 261.** Sometimes average figures are quoted taken from these books without reference to the number of years for which the average has been struck. This is very misleading although the person quoting may be acting in good faith. We have, for instance, ⁽¹⁷⁾ a rainfall which is the average for one year, and 6.6 inches in Bahawalpur State which is the average for three years. We have 6.28 in Kabirwala which is the average for 68 years.
- 262.** *In response to a question put by the Chairman, Mr. Nicholson replied: That is why I referred to Mr. Gibb's note. In the kharif it is the capacity of the canal that controls the area irrigated, and in the rabi it is the amount of water that is given.*
- 263.** **Sir Bernard Darley:** The year 1932-33, is a peculiar year to have taken.
- 264.** **Mr. Nicholson:** It is the first year of separation of perennial from non-perennial statistics.
- 265.** **Sir Bernard Darley:** That was an exceptional year of good supplies at the end of kharif season and non-perennial channels remained open into the beginning of November because there was water over and above the requirements of perennial channels.
- 266.** **Mr. Trench:** In regard to our case the position in Sind is somewhat different. We have had only two or three years working so far, and the question of what the most efficient capacity factor is, remains to be decided. I am far from denying that there is a most efficient capacity factor to which canals should be worked. Certain outlet duties were laid down in the kharif and rabi as being the utmost which we might get under the best possible conditions in Sind. But those duties, modified so as to provide for losses became full supply factor at canal heads. The result is that we have to convert what was originally designed as a duty into a full supply factor as near as we can get it. Otherwise we shall not get the intensities anticipated.
- 267.** *To a question by Mr. Nicholson, Mr. Trench said that he was referring both to kharif and rabi.*

(¹⁶) On record in Central Board of Irrigation office. (P. 2).

(¹⁷) In the Meteorological Records tabled by Mr. Nicholson: not printed.

268. **Mr. Trench—*continuing.***—The duties that have been laid down for kharif excluding rice, and rabi supplies in the Barrage canals are 100 for kharif and 200 for rabi, and the intensities proposed are normally 27% for kharif and 54% for rabi, making a total intensity of 81%. I am not including now non-perennial areas, *i.e.*, areas of rice, etc., mixed up with other ones for which additional supply was allowed. I am taking purely perennial areas. A good deal of work has been done on an experimental farm scale, and the information we have been able to get, goes to show that these duties are the ideals to be aimed at. Unless we have water running continuously we cannot get those duties combined with those intensities.
269. In the Agricultural Meeting which Mr. Anderson and I attended ⁽¹⁸⁾, Mr. Thadhani who is doing this particular work, mentioned that the duties and intensities to which we have designed, are the ideal. The reason is that in Sind, the period during which wheat can be sown is very limited and in order to get the rabi intensities, the sowing period of rabi crops has to be extended by the use of oilseed and other crops both before and after that period. The whole of our information up to date is that these duties and intensities have been pitched at the highest possible point which it is possible to work to and there is not at present any possibility of economy over them; there is ample scope for economy between what has been done in the first three years and what we hope to get, and I am not at present in a position to say that any capacity factor can be introduced which will enable us to reduce these supplies in any particular month.
270. I have put in a statement ⁽¹⁹⁾ showing in brief, the latest estimate of our requirements each month, which varies somewhat from the original project demands. They are based on reports from our local officers, and that is the best information we can get to-day.
271. In regard to the duties on the non-perennial area, *i.e.* rice area, I may say that the assumption was that we should get a duty of 50 at outlet head. That was a matter of considerable controversy at the time, and it was actually pitched at a figure which was higher than any known duty in Sind at that time.
272. Actually what we got last year on the Rice Canal, was a duty on mean supply during the whole base period, ⁽²⁰⁾ of 57 at the canal head which is very good, but the full supply factor was only 24, and if we wish to get our intensity on which the financial returns of the canals were based, that full supply factor will have to be raised from 24 to 36 at canal head. That is, there is ample scope for an increase in the economic utilization of the water which is available. Unless we get the intensities on which we have designed, the financial aspect of the scheme will be vitally affected.
273. As regards the allowances which have been made in the canals for absorption above the outlet head, they have *not* been based in the final design, on a percentage of discharges. They have been based invariably on a loss of 8 cusecs per million square feet of the wetted perimeter of the canal and that has been added between each outlet to the distributary discharge. I have taken out the effect of that and expressed it as a percentage of the discharges in all the distributaries and minors of one division. (In our nomenclature a minor is a channel of less than 50 cusecs; a distributary is a channel between 50 and 200 cusecs. Generally speaking there are no direct outlets from a branch.) The losses vary in a somewhat extraordinary manner. The actual allowances for a minor vary from 4.7% to 15.2% with a general average of 10.2%. These are the figures of a particular division of the Rohri canal and this could be taken as a representative division as it is half way between Sukkur and Hyderabad.
274. On the other hand, the distributary percentages are somewhat higher. They vary from 11.1% to 18.2% with the general average over eight distributaries, of 14.1%. As regards the actual allowances which have been made for losses between the distributary heads and the canal head expressed as a percentage, I have not worked them out, but the total result is that the allowance for perennial area, excluding the rice cultivation in these canals, amounts to 4.2 cusecs per thousand at the heads of all canals taken together.

⁽¹⁸⁾ Imperial Council of Agricultural Research : Crops and Soils Wing : 25th February to 2nd March, 1935, Old Delhi.

⁽¹⁹⁾ Appendix VI, (A) & (B).

⁽²⁰⁾ That is to say, on mean supply during the whole base period of 183 days. (See Proc. No. 650)

275. I do not think that is actually a very high figure. Of course, the conditions that obtain in other places may be different. In Sind, many of our main canals run very long distances before irrigation commences. For example, the Eastern Nara system—it is itself an old river channel with a new head to it—runs for about 123 miles down to Jamrao weir before any appreciable irrigation begins. There is little irrigation north of it.
276. *In response to Chairman's enquiry* Mr. Trench observed that there is a small regeneration during the rabi or at least an absence of loss in the Eastern Nara.
277. Similarly in the Dadu and Rice canals and to a lesser extent in the North Western Canal, there are very long lengths before we get to any irrigation which, of course, means increased loss by absorption. In regard to the inundation canals I would like to emphasize this before I make any remarks about the duties of the inundation canals. I do not know whether members of the Committee are really aware of what large important areas are still outside the Barrage command. It amounts to about one-third of the area which is commanded by the Barrage canals.
278. In the statement attached to the BRIEF ⁽²¹⁾ showing the gross culturable areas commanded by each canal system in Sind, in regard to the figures in the third line showing the area irrigable by the complete project, I would like to say that there are, in the case of the inundation canals, certain figures which appear to be anomalous, that is because the definition of a complete project in an inundation canal is somewhat vague. In the inundation canals the discharges are as a rule based on duty of 30 and 60 in the kharif season. 30 is the figure for rice and 60 for the dry kharif. There is a slight variation in Lower Sind. These duties are at outlet and, subject to an allowance for losses, govern the canal capacity. The corresponding rice duty in the deltaic area is 25. These figures are not absolutely fixed because there is a considerable controversy as to what the duty should be for rice in the inundation canals.
279. The subject is undergoing verification. But the fact of the matter is in regard to this particular enquiry, that during the time when the inundation canals are flowing—there is in fact ample water in the river for them—it is entirely a question of the level at which the river is running, which is the controlling factor. The duties also are very largely affected by the number of days on which the canal can remain open. If it is opened for a less number of days, you have to have less duties and the agricultural operations have to be hastened and intensified. I do not, therefore, like to base any argument on the existing duties in these old inundation canals, some of which at any rate are old rivers and are not efficient.
280. Chairman: What about the rainfall?
281. Mr. Trench: Rainfall is an important matter, or rather its absence is a matter of importance in Sind because it is of such a precarious character that it cannot be depended upon, and when we have rainfall the agricultural operations cannot be adjusted to it.
282. The rainfall in Sind averages from 5" to 10", and very often, as is the case in other places of precarious rainfall, sometimes there is a good deal of it in one year and nothing at all for the next 2 years or very little, so that, to all intents and purposes, except north of Sukkur where they have bosi rabi crops, rainfall in Sind is completely disregarded from the point of view of cultivation.
283. There is another point. Even if the rainfall of the kharif period *i.e.* July and August, was sufficient to be of use, the conditions of cultivation in Sind are such that it cannot be made use of. The reason for this is that the major paying crop in Sind is the kharif cotton crop. The rabi crop is only subsidiary in the greater part of Sind. Such cultivators as are accustomed to rabi cultivation, such as the Punjabi colonists in the Jamrao, very often do commence their rabi ploughing on such sporadic rain as may fall.
284. I do not think that the extent to which that is done or which could be done, would affect the economic situation in any way. But the fact is that in Sind the distribution and the intensity of rainfall is so sporadic that we cannot rely upon it for the preparation of the land for the rabi crop. The result, of course, is that our

rabi area suffers as it has hitherto suffered, because we are unable to spare water for it until the major cotton waterings are completed. The end of October or middle of November is the period up to which the cotton crops take water and beyond which they should not be irrigated. But actually the cultivators do go on watering because they find that it gives them a certain amount of extra picking. Economically, it would be better if they used the water for rabi after that period and we hope by persuasion, and if necessary by coercion and by cutting off the water supply, to stop the late watering of cotton crops to which the people are accustomed.

285. That is one of the ways by which we can improve the efficiency of our canals, but there is the overlapping period when kharif crops still require watering and preparations for rabi should be begun, and in one canal a 7% overlapping allowance has been made for that period. In other canals there is a considerable amount of non-perennial rice irrigation so that an overlapping allowance has not been made.
286. There is a further point in regard to our duties—and it is unfortunate from our point of view—and that is the mixture of rice and dry crop in the same canal. In certain canals this has become a serious problem. This is due to the fact that there is considerable difference in individual distributaries as well as in the canals themselves between kharif and rabi discharges. We have made an estimate of rice growing area and we have evaluated this on a very strict basis, and we have provided water only for those survey numbers which could be shown to have grown rice for a long time. To prove a particular survey number's right to grow rice, it had to be shown that rice was cultivated in two different periods at least once in each period. The two periods taken, were 1905/6—1909/10 and 1921/2—1923/4. This was due to the fact that within recent years before the Barrage canals were opened, there had been a definite increase in rice for which we did not want to provide rice water and so it was limited in that way. That is the position on the right bank.
287. On the left bank only a very small amount of rice was allowed for, very much smaller than the amount that was actually cultivated. The same thing applies to certain channels on the Eastern Nara system. For example, on the Mithrao canal, rice cultivation has in recent years been much reduced, as the cultivators found that cotton was more paying. It was still further reduced as soon as we opened the canals. On the Mithrao canal there were about 34,000 acres which had some claim to be allowed to sow rice whereas we actually provided for 11,000 acres which was estimated to be the area on which crops other than rice could not be grown.
288. To revert to rainfall, we all feel in Sind that our rainfall is so precarious that no economic importance can be attached to it.
289. **Chairman :** There is another point and that is the water-table.
290. **Mr. Trench :** I may say that the water table question is engaging our very close attention and we have a scheme in operation estimated to cost over Rs. 3,00,000 for the laying down and observation of pipe wells and for the testing of soils of the area which is at present threatened. We have about 50,000 specimens of soil in the laboratory at Kotri where the actual test is being made. We have not enough staff for doing this at present and we had hoped to get a grant from the Imperial Council of Agricultural Research because it is a matter not only of interest to Sind itself but also of universal interest to Agriculturalists. This hope has not materialised but the matter will be pursued. Meanwhile the work is being done at the cost of the Local Government.
291. We have also provided Rs. 59,00,000 in our Barrage estimates for the drainage of the area and the method of spending the money is now being investigated by two divisions. I merely mention this to show that the question of water-logging and sub-soil water table is not being neglected in any way in Sind and that it is being subjected, in its initial stages to very close investigation. I think it is true to say that most of the engineers in Sind, are not quite so nervous of the effects of high water table as engineers are in other Provinces. We feel that the conditions in Sind make a high sub-soil water table possibly less dangerous than in other places, and that even if a dangerous sub-soil water level is reached, it will be more susceptible to economical treatment than it would be elsewhere. We feel that

it may be better to keep the water table in control by such methods as are open to us rather than to exclude perennial cultivation from a given area. I daresay it is a fact that we regard the sub-soil water with less nervousness because in the old inundation canals the sub-soil water table rises above the ground and has done so for years without any visible deterioration of the soil. This Thigh sub-soil water table occurs only in purely rice areas.

Chairman : May I ask whether there is any project under consideration for constructing weirs for inundation canals ?

Mr. Trench : That has been suggested. As far as our figures are available it is not at all an economic proposal. The situation is rather different so far as the principal canals are concerned. For example, the Fuleli Canal has an authorized full supply of 11,500 cusecs, and takes off about 4 miles above Hyderabad. One of the few possible sites for a weir, would be several miles below so that the holding up of a volume of water would be very expensive. There is also no possibility of the extension of irrigation such as would make it economically justifiable unless it were considered as a purely protective scheme.

If canals were taken from any such weir on both sides of the river, it would undoubtedly lead to an economy of water particularly in the early kharif. Two schemes have been made for unifying the canal systems on the left bank of the river below Hyderabad—one is the Delta Canal Project, and the second was the Mirani Project which has been shelved owing to its very high cost.

Chairman : There is just another point, that is the overlapping between kharif and rabi. I understand that there is overlapping at the end of March and the beginning of April and again in September and October.

Mr. Trench : There is no overlapping of kharif and rabi in March and very little in April. The cultivator would like to have rabi water until the end of March, and we claim that normally speaking any water given to rabi after the 15th. March is useless. In order to impress this upon the cultivators, this year we adopted the closure of the canals in the middle of March.

The ordinary cotton cultivation, that is American and long staple cotton generally, is planted in April, and if water is taken by people who go in for long staple cotton on the 1st. April, there is almost a coincidence but no overlapping. But in the October-November period there is serious overlapping, for deshi cotton matures later. In the old inundation canals, the cotton area was very limited, and the crop was sown in June. It was found only in the area north of Hyderabad, now taken over by the Rohri Canal. It was sown generally as soon as the canals were open early in June, and it did not get water after the end of October.

Mr. Nicholson : As regards this question of the effect of the Barrage withdrawals, I suppose Mr. Trench is aware that the Government of India's letter No. 1735 of the 11th. November 1906 forwarded a note by the Inspector-General of Irrigation, which indicated that the eventual requirements of Sind would probably be met by barrages at :—

(i) Mithankot, (ii) Sukkur, and (iii) Kotri.

So it was foreseen ⁽²²⁾ that the construction of the Sukkur Barrage would have an effect on the inundation canals taking off down-stream of Sukkur.

When the Sutlej Valley Project and the Sukkur Barrage Project were under simultaneous consideration, the question of the barrage at Mithankot was considered at that time by the Inspector-General of Irrigation to the Government of India, and it may not be out of place to put this on record. This map ⁽²³⁾ was sent to the Government of Bombay under cover of a letter No. 3618-W.I., of the 19th. November 1921. Mithankot is just below the junction of the Panjnad and the Indus. The idea of that barrage was to control and give an assured supply to the inundation canals in Sind taking off above Sukkur. When the Panjnad Weir was proposed it became evident that instead of building a barrage at Mithankot it would be a cheaper undertaking if the second one was built at Dera Ghazi Khan as it would give an advantage of constructing the weir on the Indus above the junction, and

⁽²²⁾ Appendix A. Vol. II. Sukkur Barrage Project.

⁽²³⁾ Not printed.

a canal could be taken off from there which would control the whole of the right bank inundation canals of Sind and the Punjab with the Indus series in Muzaffargarh District.

300. Those on the left bank of the Indus could be given a controlled supply from the Panjnad. The Bombay Government, however, in their No. 2969-I. of 15th. May 1923 indicated that there would be no necessity for them to take a controlled supply from Panjnad. I just mention this point as it indicates the improbability of the necessity for a weir or barrage on the Indus for the Sind inundation canals above Sukkur, more especially as in the joint note of the two Superintending Engineers from Bombay and the Punjab on the effect of the Bhakra Project on the Sind inundation canals, it appeared that the construction of the Sukkur Barrage would cause an accretion of levels upstream which would improve the condition of the inundation canals in Sind.
301. It appears from page 8 of Volume V of the Sukkur Barrage Project 1919, Statement III, that a very considerable supply, amounting to 1,435 cusecs, for the North Western perennial canal is provided for in March for kharif crop during rabi season which shows a very considerable and almost abnormal overlapping.
302. **Mr. Trench :** When I spoke of overlapping in the autumn season in the Rohri Canal which amounts to 7%, i.e. above the full supply of the canal, I think it will be found that the overlap allowance does not increase the full supply discharge.
303. **Mr. Nicholson :** Mr. Trench has stated that the water requirements of the crop have been determined by the Agricultural Department, and it is on such data that the requirements have been supported. It is well known in the Punjab that the Agricultural Department endeavour to show the greatest outturn per acre of crop and pay no consideration to the greatest outturn per unit of water available. As such it is felt that the most economical use of water will not be obtained by working on the results of the Agricultural Department as heretofore practised.
304. When the Sirhind Canal was constructed on the data then available it was anticipated that only 20% intensity of irrigation would be obtained, but with the same supply from the same river at the present time that figure of 20% has increased to 60% which shows how far wide original estimates may vary from ultimate results. The capacity of the Sirhind Canal as originally constructed, was 6,000 cusecs and the mean rabi supply of the order of 4,500 cusecs. This increase from 20 to 60 per cent. has taken place without any increase of supply, the only increase being that of the capacity of the canal from 6,000 to 8,750 cusecs.
305. To take another case, the Sidhnai canal was constructed with an anticipated intensity of 20%. This figure, with no increase of supply or increase of capacity, has now risen to 80% showing how the efficiency of the use of water has developed.
306. Mr. Trench has indicated his outlook on water-logging and how they have no fear as in the Punjab. I think Mr. Trench referred to the fact that the kharif was their major crop and the rabi was their minor crop. This is most re-assuring because it is contrary to the Punjab conditions, so that we feel that when the Punjab's need is greatest from the rivers, that Sind will be prepared to help as it will inconvenience them least. Mr. Trench also referred to the wheat sowing period being limited.
307. **Mr. Trench :** Generally speaking you cannot sow wheat before November, otherwise it is likely to be destroyed by frost. Wheat should not be sown after Christmas otherwise no economic outturn will be obtained, so that two months is the outside limit: it ought to be 6 weeks from the beginning of November till the middle of December.
308. **Mr. Nicholson :** Is sugar-cane in any way a crop of importance?
309. **Mr. Trench :** No. At present there is very little sugar-cane grown. Only one firm has started growing it on a commercial basis and they have just started a factory.
310. **Mr. Nicholson :** That is to say the Sindhi has no experience of sugarcane.
311. **Mr. Trench :** No.

312. **Mr. Nicholson :** Do you find that the Punjabi emigrants show any desire to grow sugarcane ?
313. **Mr. Trench :** It is not grown on a commercial basis. One Punjabi cultivator actually put up a factory for sugarcane many years ago, but it has never been worked.
314. **Mr. Nicholson :** Could you tell me as to how the duties on the areas irrigated so far, compare with what was anticipated ?
315. **Mr. Trench :** They are nothing like what we anticipated. We get them on the distributaries, not on the whole canal.
316. **Mr. Nicholson :** That is to say on certain channels you have full supply factor and duties greater than anticipated.
317. **Mr. Trench :** Not greater. They have been exceeded nowhere.
318. **Mr. Nicholson :** You remarked that on the rice canals you obtain a duty of 57 and a capacity factor of 0·24.
319. **Mr. Trench :** 24 is the full supply factor. 57 is the duty on the mean supply.
320. **Mr. Nicholson :** You say your capacity factor was 0·24. What is 57 ?
321. **Mr. Trench :** 57 is the duty at the head of the canal on the mean supply.
322. **Mr. Nicholson :** In the project, the duty was taken at 43·5 from which we see there is an improvement over conditions assumed in the Project.
323. **Mr. Trench :** 43·5 is the assumed "duty" really the full supply factor at distributary head. The "duty" as it was called, or full supply factor really, at canal head was to be 36.
324. **Mr. Nicholson :** What is the full supply factor ? 24 ? The duty arising therefrom on the mean supply was 57, which is an advance on 43·5.
325. I understand Mr. Trench to accept this point, but would like to point out that in the printed BRIEF, the difference between mean and average supply and full supply factor was not understood. As a matter of fact, the duty on average supply is meaningless as it would not be a common base unless the canal ran for the whole period of the crop without closures, in which case the average would be the same as the mean.
326. **Sir Bernard Darley :** Did I understand you to say that at outlet head you give 2·8 cusecs per 1,000 acres—that is on the assumption that the channel is going to run continuously, and therefore for a channel to run half time you would give 5·6 cusecs.
327. **Mr. Trench :** Yes.
328. **Sir Bernard Darley :** The other thing I want to refer to is the cotton period at the end of the season—the overlapping period. Mr. Roberts who is an eminent agriculturist and was on the Sutlej Valley Committee, and is a great authority on cotton, has taken a large area under cultivation on the Sukkur canals, and he has also taken 8,000 acres on the Panjnad canal for temporary cultivation.
329. I was talking to one of his assistants and he was telling me that they carry on sowing cotton in Sind much later than in the Punjab and consequently it is a question of picking later, as Mr. Trench says, right on until the frost comes, sometimes until the beginning of February. I found in the last two years on the Panjnad that people were demanding water in October in the upper reaches for cotton. They must have a good supply for cotton in October, so much so that they left their rabi, and it was then that I approached the Bombay and the Punjab Governments to run our non-perennial canal until the end of October on condition that we did not open till the 15th. April and that was approved of by the Bombay Government, and the Punjab Government also gave permission.
330. **Mr. Nicholson :** Excuse me, not the Punjab Government.
331. **Sir Bernard Darley :** Anyhow, the Chief Engineer and Secretary to Government gave us permission. We were allowed to run on. That is a concession of the utmost value in a non-perennial channel by which people can sow cotton so much later when supplies in the months of April and May are likely to be precarious or restricted. I do not know if your cotton is all grown on the perennial channels ?

332. Mr. Trench : Yes.

333. Sir Bernard Darley : But it would be of the greatest help to the Panjnad canal if we were permitted to arrange to open the non-perennial canal on the 15th. April and to keep it open till 31st. October as a permanent measure. I bring it in, as it bears on this point and I am backing Mr. Trench that conditions are not the same as in the Punjab in connection with overlapping at the end of kharif.

334. Chairman : Could we not bring it under Item 6 ? I think it will fit in better there.

335. Mr. Sladen : There is one thing about wheat. Our experience in Khairpur is—and I think this applies to the northern part of Sind, Nasirabad Tehsil and Baluchistan which gets water from the North Western Canal—that we require water for wheat at least up to 20th. March. When I was in Khanewal on my way here, I was told that they also take water for wheat up to 1st. April.

336. Sir Bernard Darley : As regards duties, I do not feel justified in saying anything about them. I have just come to the Punjab. Water is given, not so much as a question of duty, as so many cusecs at the outlet head per 1,000 acres. When I took over I found that on the perennial canals, water had been given at the outlet head on the basis of 4.2 cusecs per 1,000 acres, and on the non-perennial canals at the rate of 5.5 cusecs per 1,000 acres. As I have said, though the project is designed on the basis of running "alternately", sometimes we are only able to get water for one period in every four. The result is that, with this big outlet factor we are able to give a flush of water quickly if the distributaries are open for only three days in a month. It has been purely a matter so far, of working to what has already been handed over to us.

337. In connection with the Panjnad and Abbasia areas, I should be prepared to accept whatever it is proposed to give in connection with the Haveli Project ; that is, we should get 4 cusecs on perennial channels for every 1,000 acres of gross command at the head of the canal, or 6 cusecs per 1,000 acres for non-perennial channels at the head of the canal. If that is allotted to us, it seems only fair that we should be placed on the same basis as Sind as far as other matters are concerned.

338. As far as rainfall and water-table are concerned, our rainfall is just the same as Sind's. We get our rain spasmodically. We may have 5 inches of rain falling one day and no rain afterwards. That is what happened last year.

339. As regards water table, every single record has been taken away by the Punjab engineers. Perhaps they can give details.

340. Mr. Nicholson : I place here some maps of water-table contours in Bahawalpur. The information is in a convenient form and has been brought up to date for three different years.

341. Sir Bernard Darley : *In reply to a question by Mr. Betterton*—I have been told for instance that on the Eastern canal the brackishness of the water has enormously improved. I have always heard that it does not spoil the land to give more irrigation

In regard to water-logging, my opinion may be different to others'. Water-logging nearly always follows where there are large canals. It is due to seepage from canals and not to water used for irrigation. Dr. McKenzie-Taylor, I believe, agrees with this view.

342. Mr. Nicholson : Dr. McKenzie-Taylor in some cases correlated rise in water table with rain-fall : in others he correlated it with irrigation, and in some cases he could not correlate it with any known factor.

343. Sir Bernard Darley : The real point is that where the tail of a canal is very far removed from a river and where the spring level is very low no water-logging takes place

344. Mr. Nicholson : In the Lyallpur area near Sangla the sub-soil water level was 80 feet below surface, but it has now risen, and the surface of the country is being devastated.

345. Sir Bernard Darley : I find it very hard to specify the probable losses in channels. They differ in different times of the year. The losses in the early portion of rabi, in the latter portion of rabi, and in the kharif, are all different.

346. **Mr. Nicholson :** Sir Bernard seems to ally himself with Sind in a matter like rainfall, but he does not seem to sympathize with us who are similarly situated.
347. **Sir Bernard Darley :** I quite agree that the conditions at Haveli are the same as at Panjnad.
348. *Sir Bernard Darley gave Mr. Foy his experience in regard to duties on his own distributaries, in areas which are fully colonized.*
349. *Mr. Nicholson pointed out that Sir Bernard's reference to the outlet being of a high capacity in Bahawalpur was explained by the fact that there was far too little area to be irrigated.*
350. *Sir Bernard Darley said he was only explaining, not criticising.*
351. *The Chairman adjourned for luncheon at 12-45 p.m. The Committee was entertained by the Hon'ble Sir Frank Noyce, K.C.S.I., C.B.E., Member for Department of Industries and Labour.*
352. *The Committee re-assembled at 3-00 p.m.*
353. **Mr. Sladen :** On the Sukkur Barrage Mr. Trench said that they were hoping to work to 200 in rabi and 100 in kharif at their distributary outlet heads. In the 1919 Project Volume XX, page 5, paragraph 16, the figures for canal head duties are given as 72·5 for kharif and 145 for rabi. Is that correct ?
354. **Mr. Trench :** I shall have to verify.
355. **Mr. Sladen :** That is what theoretically they hoped to work to. The eventual anticipated cultivation in kharif, I believe, is 3,068,710 acres : that is, after converting rice area of 762,567 acres into dry crop, the total dry kharif becomes :
- | |
|------------|
| 2,306,143 |
| 762,567 |
| 3,068,710. |

The maximum discharge is 45,926 cusecs. So the estimated full supply factor for dry kharif is 67 (this is obtained by dividing the area in acres by the maximum discharge in cusecs), which is not quite the same as 72·5. Mr. Trench wishes to reserve the right to verify these figures.

356. **Mr. Nicholson :** Does that include rice ?
357. **Mr. Sladen :** Rice is converted to dry crop. These figures are taken from the project. What I wanted to show was that although they quote in the book 72·5, it works out at 67 for the whole area.
358. The maximum dry kharif area is 2,306,143 : Project Vol. V, page X, Statement II : it is the area of anticipated cultivation in 30 years after completion of all canals.
359. Full supply factor (mixed kharif) is about 50 acres ; rabi figure from the same statement :
- | | | | | | | |
|-------------------------------------|----|----|----|----|-------|----------------|
| Wheat | .. | .. | .. | .. | .. | 2,540,000 |
| Other leguminous rabi crops | . | .. | .. | .. | . | 622,000 |
| | | | | | Total | 3,162,000 |
| Discharge of water supply : maximum | .. | .. | .. | .. | | 25,897 cusecs. |

360. Thus the rabi estimated duty works out at 122 and is also less than 145.
361. The State's culturable area including 20,000 acres of British enclaves is 600,000 acres. Intensity is 81%. 81% of culturable acreage is 486,000 acres and we ask for water supply to enable us to cultivate approximately that figure only, so that we may be on equal terms with the rest of Sind. According to the full supply factor of 72·5 and 145, 2,234 cusecs of perennial water would suffice.
362. But I wish to show that it is hardly fair that we should try to work to the same duty as the Barrage try to work to. In the first place the irrigable area of the State has been bisected by the Rohri Canal. The eastern half which is commanded by the East feeder, is long and narrow shape. Its length is 72 miles north to south, and its width varies from 5 to 15 miles. Moreover, about three-quarters of the southern part is interspersed with sand dunes, and the soil in that area is light and sandy. Therefore losses by evaporation and absorption are heavier than in

the adjoining British territories. Moreover, more frequent waterings are required to mature the crops. In certain canals under the Barrage they have also given different duties for different areas, as I have shown.

363. In addition to that there are 40,000 acres of shikargahs and these require water in kharif and rabi. For these reasons we ask that a full supply factor, lower than that fixed for British territory, should be fixed for Khairpur State. I suggest a full supply factor of 50 in kharif with double duty for rabi. In the 1909 Project, Dr. Summers recommended a full supply factor of 50 in kharif for Khairpur State. The same figure was adopted by Mr. Musto in his 1919 Project Volume V, page 10. On this basis and on the same proportion of cultivation between kharif and rabi as is adopted in British Sind, the State has a right to receive a perennial supply of 3,000 cusecs. Then, as an equal participant in the scheme the Khairpur State has a legitimate claim to a supply of 3,000 cusecs perennially.
364. However, we know that there is difficulty in providing water in the rabi season, and in the negotiations with Bombay Government we have expressed our willingness to accept a full supply of 2,000 cusecs only in January, February and March with a slight increase in the existing maximum for kharif. We now get 4,000 and I think the figure should go up to 4,500.
365. The anticipated duties of 50 and 100, will give an annual cultivation of 225,000 acres in kharif and 200,000 in rabi which gives an intensity of 75% as against an intensity of 81% in British Sind. We do not think that we shall be at any appreciable disadvantage by adopting a lower intensity. That is all about duties.
366. As regards rainfall I have nothing to add to what Mr. Trench said. Our rainfall is entirely useless and cannot be relied upon.
367. The methods of cropping we adopt are the same as in the rest of Sind. The only difference is that we require water for wheat a little later than in Southern Sind, but that is a domestic matter between us and the Sukkur Barrage, and we have to adopt their dates of closure.
368. As regards sub-soil water table there is only water-logging appearing in the State within two miles of the Rohri Canal for 25 miles along the whole length from the head to Tando Masti Khan Falls. In another place about 5 miles below the fall there is waterlogging. Nowhere does it extend beyond 2 miles from the canal on either side. We have observation pipes in the same manner as the rest of Sind and records are kept of sub-soil levels.
369. Mr. Betterton: Did you not in your BRIEF suggest that you should employ a lower factor also on the score of antiquated channels?
370. Mr. Sladen: That comes in really on the financial side. The Project says that 4,000 cusecs in kharif will enable us to cultivate 300,000 acres, *i.e.* give a duty of 72.5. We say we have got our antiquated channels, and we cannot get that duty from them, nor, if we have to pay for that supply of water, will it be economically possible for us to pay for the modernizing of our channels and complete a remodelling scheme. Moreover we say that an intensity over 50%, during kharif is agriculturally impossible. In Sind soils it is impossible. They cannot cultivate dry kharif in alternate years.
371. In reply to a question by Chairman—Mr. Sladen. On the East Feeder out of the gross area which is 470,000 the culturable area is 320,000 acres. The length is 70 miles. In the first 20 miles there is no sand; after that there are sand dunes; then a good valley, then sand dunes. That explains the difference between the gross and the culturable area.
372. I should like to say that sub-soil water below 20 miles from the head of canals is everywhere very low—it is about 30 ft. deep. It is in the first 20 miles that there is danger of water-logging. Within 20 miles of Khairpur town there is a well just on the edge of the sandy desert where the water supply is 200 feet down. So it does go down rapidly towards the desert. I support Mr. Trench and say there is not much danger of water-logging.
373. Mr. Foy asked whether 50% kharif irrigation would be ruination to the soil and whether rabi water had that fine fertilising clay silt, that kharif flood water carries.
374. Mr. Sladen said they had found that by rotating wheat and cotton there was no exhaustion, his experience was that perennial cultivation would be less of a drain on the soil, as this rotation was suitable.

- 375.** *To Mr. Trench, Mr. Sladen.* The large shikargah areas take a great deal of water, and it is very difficult to control it. There are no outlet heads, and they take whatever water they like and at whatever time.
- 376.** *To another question of Mr. Trench, Mr. Sladen.* The duties of 50 and 120 were fixed by Dr. Summers and substitute our demand for an extra 500 cusecs for kharif and about 2,000 for rabi from January to March is not a large one.
- 377.** *To Mr. Nicholson, Mr. Sladen.* The 400 cusecs discharge at outlets for the Nara tract in the Khairpur State was asked for by the State Engineer. This quantity is for an area irrigated by the Eastern Nara Channel. It contains some shikargahs. We now take some water, but not the full 400 cusecs. We do not wish to give up the 400 cusecs on the Nara and in fact we may at a future time ask for an increase if the water is available. That is because the area can be exploited, but there is no question of exploiting it at present. This area is about 50,000 to 60,000 acres of culturable land; it may be even more.
- 378.** **Mr. Nicholson:** It is rather difficult to expect the Government of India or any other agency to assign water for shikargahs, when there is a large population pressing for food.
- 379.** **Mr. Sladen:** The Bombay Government had to take the canal through the State and the State requires a *quid pro quo*.
- 380.** **Mr. Nicholson:** Mr. Sladen states that although this may be a shikargah only, but when a canal is taken through a State there must be a *quid pro quo* and it is quite reasonable to demand irrigation for this area. In the past, this shikargah has been a source of pleasure to the Rulers of the State and it has never had regular rabi irrigation in the past. The point is, in the past the shikargah, even in good years did not get water after October, except a small amount passed into the head of the canal in some years in November. This points to the fact that irrigated plantations do not need water in the rabi and in the past without rabi irrigation they fulfilled their functions. There appears no reason to grant any consideration to a rabi supply for such areas.
- 381.** As regards the lower portion of the canals, with a light soil interspersed with sand dunes, more frequent waterings are claimed. This is entirely contrary to all recorded experience with this class of soil. A light loamy soil can do with far longer intervals between waterings than hard land. If Mr. Sladen maintains his point that this land is unfertile excepting under special conditions, it would appear that the proposal to irrigate this area is an uneconomic one.
- 382.** As regards the duties proposed—50 in the kharif and 100 in the rabi—this duty of 100 in the rabi, it is admitted, is due to the fact that the channels will run full supply the whole time, so that the capacity factor will be unity and duty and full supply factor the same.
- 383.** **Mr. Foy:** The Chairman asked me to state my duties at canal head. So far, I think, most of the duties have been stated at distributary head, and I have got the other data as well. The average duties at canal head from 1929-30 are:—
- | | | | | | | | | |
|--------|----|----|----|----|----|----|----|-----|
| Kharif | .. | .. | .. | .. | .. | .. | .. | 101 |
| Rabi | .. | .. | .. | .. | .. | .. | .. | 179 |
- The number of years is too small to give accurate results especially in rabi. Two years the supplies were generous and duties dropped. The rabi duty in years of short supply at canal head is 200 at present.
- 384.** **Mr. Foy:** *In reply to a question*—Losses in the main line were less than normal, as the channel was lined, but there was a reach of 5 miles at the head left unlined, owing to high spring level and the losses in that reach are phenomenal. I do not claim to state this on my own observation, it is merely what has been told me by every Punjab Superintending Engineer who has run the canal. That part of the canal lies under Punjab control. However, I thought I would just mention that. Also our length is very considerable—85 miles from the head. The head duties run at 101 in kharif and 179 in rabi. At present the colony is fairly fully developed and has been so since 1929-30. The present area occupied is 580,000 acres out of 630,000 to which water is given. Thus the colony is about 92% occupied. Some of this is under temporary cultivation and there is some danger.

Mr. Sladen has noted that if superior intensities and lower duties are adopted in the neighbouring tracts the zamindars—invariably penny wise and pound foolish—would emigrate on to the neighbouring tracts.

385. The rainfall from the year 1927-28 to 1934-35 averaged about 9·17", of which 7·69" falls in the monsoon. This is very much the same as in the Eastern Sadiqua tract lying alongside. The soil for the greater part of the area is a light loam. In that part of the area known as Ghaggar head, the soil is clay.

386. The division of the discussion into questions of duties and intensities makes discussion rather difficult because the two are interlocked. In my opinion the best criterion is the supply at canal head per thousand acres of culturable commanded area. I have had this statement worked out from the culturable commanded areas and river supplies given in the BRIEFS. It might interest the Committee.

387. Mr. Foy distributed copies of the statement to the members ⁽²⁴⁾.

388. I have one other point. On this chart, ⁽²⁵⁾ which I pass round, I have plotted the kharif duties at distributary head against the kharif capacity per thousand acres in cusecs—also at distributary head. This shows fairly clearly, I think, how the duty falls off as the capacity per thousand acres increases. This confirms what Mr. Nicholson was saying this morning about the law of supply and demand as originally put forward by Mr. Gibb.

389. Our duties are higher but our kharif supply has been lower than the project anticipated.

390. Mr. Nicholson: There is some misunderstanding about the kharif supply. I would invite a reference to the minutes of a meeting in connection with the Sutlej Valley Project at Delhi from the 10th.-14th. December 1919, Proceedings of the Third Sitting, item No. 126 page 14. The official resolution was as follows:—

391. "That as a result of these meetings which we are now about to close, the Government of India be asked to issue instructions for the preparation of a project on the lines agreed upon in this Committee and as defined in Appendix B of the proceedings as modified in the following particulars".

392. If you will turn to Appendix B you will be surprised to see that there is no mention of kharif supplies. This resolution under which the project was prepared was accepted by all parties. The only mention of kharif supplies is in an enclosure to Mr. Ives' letter. The basis of the project quoted above made no statement of kharif supplies because it was realized that there were no reliable data. As the supplies were short in the early kharif, it was decided that the total area of irrigation would be attained as water was available from June to September and fodder crops, maize and rice would be irrigated during this period. In any case there is no mention made of the kharif supplies.

393. Chairman: I don't think this is a matter relevant to the issue.

394. Mr. Nicholson: Because the discussion arose I pointed it out.

395. Chairman: Mr. Foy, have you anything to say about rainfall?

396. Mr. Foy: We have rainfall of about 9" of which 6" to 7" is in the kharif. It is identical with the average rainfall on the Pakpattan and Eastern Canals. The sub-soil water table is about 80'—150' below natural surface.

397. Mr. Trench: What is the loss of your lined Canal? Does that amount to an appreciable figure?

398. Mr. Foy: It is extraordinarily difficult to say. The Punjab control most of the main line and after very careful experiments say that it must be about 2 cusecs per million square feet.

399. Mr. Oram promised to furnish the Committee with figures of gross area, culturable commanded area, etc., in respect of rabi and kharif in about 2 or 3 days time.

400. Chairman: Let us now take ISSUE NO. 4. Mr. Trench will open the discussion.

401. Mr. Trench: I have not much to say on this but shall explain my point of view. I think the basis ought to be the culturable area because the gross area

⁽²⁴⁾ Appendix VII.

⁽²⁵⁾ Plate II & Appendix XX.

might be a very indefinite figure. If it is according to the gross area, there may be certain lands within the area which it is impossible to irrigate at all but if this figure is used as a basis the remaining area would have an undue advantage. Personally I cannot see any point of view from which it is possible to advocate the gross irrigable area. Of course, if you do not know what the culturable area is, then you would have to work on gross area but there is no advantage in doing so even then. It is better to wait and know what the culturable area is.

402. **Mr. Nicholson :** In Sind you have such a high intensity of culturable area to gross as shown from the statistics you have put forward. In one particular canal it was 97% culturable to gross : in other canals also it is so high in Sind that it makes very little difference.
403. **Mr. Trench :** That may be so. But I am speaking purely on the principle.
404. **Mr. Nicholson :** When you have such a high intensity, it is essential to see that you have land available to produce that area of crop, but when the project is prepared to irrigate only 50% of gross then minute data is not so essential. Neither Bikaner nor the Punjab under the Sutlej Valley Project, it may be remembered, had an intensity of much more than 50%, and therefore there can be no difficulty in finding the area on which to utilize the water.
405. There is this question that has been found in the Punjab. When starting a canal project, it is extremely difficult exactly to define the culturable commanded area. Supposing a project is framed on a basis of 60%. When it comes to allotting water to each village, the door is opened to corruption of the subordinate staff. For this reason water is allotted to village lands on a low intensity on the gross commanded area. Attempts have been made from time to time to readjust according to the culturable commanded area the old villages in the Eastern portion of the Punjab.
406. **Chairman :** We are not discussing any particular canal, only the principle.
407. **Mr. Nicholson :** I simply mentioned the actual practice.
408. **Mr. Foy :** It is not the actual practice when you design a modern canal. Such a design should be carried out on the culturable commanded area.
409. **Mr. Nicholson :** I was only referring to old canals.
410. **Mr. Foy :** When you design your chaks for new canals would you design your chaks on the gross area ?
411. **Mr. Nicholson :** Of course the modern canals have got rectangulation as the basis. I am talking about only the old village lands where the culturable commanded area, I think, is possibly a little higher.
412. **Mr. Trench :** In the question of commanded area you include lift lands ?
413. **Mr. Nicholson :** We work on gross.
414. **Mr. Foy :** We have excluded the lift areas.
415. **Mr. Nicholson :** On the Lower Chenab Canal there is a considerable number of small lift areas.
416. **Mr. Trench :** I understand that in certain of the Barrage canals, villages and roads were excluded from the gross area.
417. **Chairman :** In the United Provinces the gross area is the entire area within the extreme limits of the project on the assumption that water is unlimited.
418. **Mr. Trench :** In most of the Provinces the principle seems to be the culturable area.
419. **Chairman :** The principle is different in every Province.
420. *After discussion it was decided that each Member should record in writing, the principles observed in his Province. These are recorded in Appendix VIII to this record.*
421. *The Committee then adjourned till 9-00 a.m. on Sunday the 3rd March 1935.*
422. *The Committee re-assembled at 9-00 a.m. on Sunday the 3rd March 1935.*
423. **Chairman :** Gentlemen, the definitions of culturable commanded and gross commanded areas have not been handed in to the Secretary yet, so I suggest we now pass on to ISSUE NO. 5.

424. Mr. Nicholson : In previous meetings regarding discussions on supplies available on the Indus and its tributaries, the first difficulty has been that the data were unreliable, or said to be unreliable, and open to question by all parties. It was in consequence of this, that the Government of India, on the advice of the Inspector-General of Irrigation, in their No. 14-1 of 10th. January 1921 arranged that a complete series of daily discharge observations should be made at all important points on the Indus and its tributaries. There were to be two special Executive Officers, one in each Province, whose sole duty was the obtaining and the recording of the data and it was to be agreed upon between these officers individually, that the methods were similar and the results were acceptable to each other. Once a year there was to be a meeting of the Indus Discharge Committee, of which the Inspector-General or the Consulting Engineer to the Government of India was to be President and the results obtained during the year were to be reviewed. The methods of discharge observations were improved from surface floats to the universal use of current meters by 1924-25. In Sind, current meters had been used from the commencement of their observations, about 1902. Unfortunately, since the post of Consulting Engineer to the Government of India was abolished, there has been no meeting of the Indus Discharge Committee since 1929. But the observations, have been continued and the Executive Engineers of the two Provinces concerned, have been in close contact and visited and inspected each other's sites to satisfy themselves that the data obtained were reliable and acceptable to both parties.
425. *The hydrographs of the Sutlej at Adamwahan ⁽²⁶⁾ from 1921-22 to 1934-35 were studied by the Committee after the inspection of the whole of one year's records for the five years showing how the data were compiled.*
426. For the Punjab there are some 28 subordinates observing in the field at sites other than head works, where the work is done by the local subordinates. The compilation of the records and checking is done in the Divisional Office by a staff of some 18 computers and draftsmen. In addition to the Executive Engineer there are 3 Special Sub-Divisional officers controlling the work in the field and checking actual observations. It is noticeable from the hydrographs at Adamwahan, that the Sutlej is practically dead from the end of September to late in June or early July. The hydrographs for Adamwahan are obtained by plotting daily observations. The hydrographs for the supply in the rabi below Sidhnai are not so important and have been compiled on 10-day averages. From these it will be noticed that there is generally speaking, little or no surplus before the beginning of July or after the end of the last 10 day period in September.
427. Similar hydrographs for the Chenab at Haveli plotted daily, are put forward for inspection. ⁽²⁷⁾.
428. Hydrographs showing the daily discharges for the Chenab at Panjnad are also tabled.
429. A blue print has already been put in ⁽²⁸⁾ showing the average supplies in the Punjab rivers above the Upper Canal Headworks for an average of the 12 years from 1922 to 1933 which gives a bird's-eye-view of the conditions. The totals of the Chenab, Jhelum and Ravi and the total of Sutlej and Beas are also plotted separately. From these, the various characteristics of the rivers can be seen at a glance.
430. The figures of gains and losses of supplies recorded in the registers that were already inspected, ⁽²⁹⁾ have been plotted and are put forward for examination by the Committee.
431. Hydrographs are also tabled, showing by 10 day periods, the losses or gains of supply in the Chenab from Trimmu to Shershah and Panjnad. These are plotted without any consideration of the time lag. The results would be very much more consistent if this factor could be taken into consideration.

⁽²⁶⁾ On record in Central Board of Irrigation office. (P. 3—16).

⁽²⁷⁾ These hydrographs, and others mentioned in Proc. 428—436 are on record in Central Board of Irrigation office. (17—92). One is shown as Plate III summarising the information obtained by the Committee; upon which their recommendations are based.

⁽²⁸⁾ Data given in Appendix V.

⁽²⁹⁾ Records of the Discharge Division, (Punjab).

432. In addition to the daily hydrographs of the Chenab at Haveli and Trimmu and the Chenab at Panjnad, similar ones for 10 day periods have been prepared and are exhibited to simplify matters.
433. Hydrographs of the Chenab component at Panjnad showing gains and losses below Khanki and Rasul are also displayed.
434. Another series of hydrographs are put forward showing supplies in the Ravi passed from Balloki to Sidhnai Headworks, the absorption losses below Balloki and water utilized in the Sidhnai canal.
435. A hydrograph has been prepared showing the effect on the discharge of the canal at Panjnad of the Sutlej Valley Project and Haveli Project completed and working.
436. A diagram is submitted for consideration showing the water available in the Indus below Sukkur as actually observed from 1928 to 1935 by months.
437. **Mr. Trench :** The Sind case is rather the reverse of the Punjab, Bahawalpur and Bikaner cases. We are not at the present moment claiming any additional water from the Indus or its tributaries and we are in the position of having the supply of water which we hope would be assured to us and therefore it is rather our position that we have now reached the minimum supplies in the river with which we can deal or which are sufficient for our commitments in Sind.
438. This point is divided into two parts, firstly the supplies for the Sukkur Barrage canals and secondly the supplies for the inundation canals. In regard to the Sukkur Barrage canals, I am not prepared to state that the supplies are substantially short of what we expected to get. On the other hand, I do not propose to go quite as far as Mr. Nicholson, who shows in his diagrams which have been based on monthly averages, that there have been no occasions on which our supplies have been short. What we would rather state is that we have now come down to bed rock in Sind for the supplies that we require.
439. Dealing first with the supplies for the Sukkur Barrage canals, there was in the BRIEF a table showing the number of days on which the supplies were short, allowing for the supplies which we have hitherto been unable to prevent passing the Barrage due to conditions as they at present exist. We have been making strenuous efforts to reduce the leakage which occurs through the gates. It is reduced in the course of the season—and the staunching of these gates (which as you know number 66), is a matter which cannot be done in a day or two. Very often during critical times, we are unable entirely to stop the leakage.
440. In order that there should be no feeling that there is waste and that it is up to us to stop this leakage, I have also here a statement ⁽³⁰⁾ showing the number of days on which we were short of supplies entirely omitting the 3,000 cusecs which we have been unable to staunch or unable to account for. I have only one copy of this statement and so I will reproduce the figures. In certain cases, especially in the year 1932, when we first worked the gates, some of these days in which shortage occurred may have been due to a manipulation of the gates. That is to say, the rise in pond level would show temporarily a lower discharge upstream than is actually there.
441. In 1932, under our present authorized withdrawals excluding those which Khairpur are demanding, we were short of water in two days in January and 3 days in February. In 1933 we were short of water in 17 days in February and 17 days in March. In 1934 we were short in 9 days in March and 17 days in April. Including the additional demands for Khairpur, and for the British canals, there were in 1932, 4 days in January, 6 days in February and 3 days in March : in 1933, 7 days in January, 25 days in February and 19 days in March : in 1934, 3 days in February, 17 days in March and 16 days in April. I do not in any way claim that these have done serious damage, but I do claim that it is an indication that we are now very close to the limit of the available supplies. It is always open of course, to people to say that these were exceptionally bad years, but it is impossible to say to what extent these similar bad years will recur, because some of the Punjab schemes have only been in operation during recent years and therefore it is not possible to say to what extent they will affect discharges in future years.

442. In regard to the inundation canals, that is a very much more difficult question because it is not a question of supplies; it is a question of levels in the river. I am perfectly prepared to admit that during the period of flow in the inundation canals, there are ample supplies available. But in the case of inundation canals, both above and below Sukkur, the question is one of levels and is one really, of the number of days on which the canals are capable of flowing at the full supply discharges.
443. We generally reckon, in an inundation canal, that we must get the full supply discharge for 45 days or a total of 90 days. The inundation canals are generally rice canals. I may also make it clear that it is impossible to convert these into anything but rice canals because of the conditions of the soil. The soil is not unculturally saline, but saline to the extent of being unsuitable except for rice. It is not black cotton soil. Moreover, owing to the brevity of the period during which these canals are run, you can only grow a short period crop and such crops as cotton are impossible because you have to have a longer period of flow. The evidence in regard to these inundation canals indicates that the length of time during which they can be run at a low level as well as at a high level is shortening.
444. There are two main gauge readings on which we depend at Kotri and the same thing applies to the Upper Sind gauges. There are two levels which we particularly look at—one is 12' at Kotri which is the level at which most of these inundation canals can be opened. There is one exception to this and that is the Fuleli which is a very large canal and has a rather lower bed level, so that it can get water from about 3' at Kotri. Otherwise the gauge at which most of these inundation canals can be opened is about 12'. I could have given you similar figures at Sukkur but the Sukkur gauge is now out of action because of the heading up at the Barrage and we have transferred our observations for the purposes of inundation canals to Sarhad.
445. We have not had the Sarhad gauge for a prolonged period, and so the figures of gauge readings at which we can normally open the canals cannot be fixed to the same exactitude as at Kotri. I took Kotri only as an illustration. The question is then whether there is any marked change in the number of days which the river is capable of flowing at 12' at Kotri, in the initial stages. Then we have another gauge which we look to at Kotri which is called the fair irrigation level that is 18½'. That does not represent the actual gauge at which the full supply is obtained for all the inundation canals. In some canals we get the full supply level only if the river rises to about 22', but it is the gauge which we use as a measure of the adequacy of high level flood supplies. I have taken out some graphs showing the movements in these gauges. These graphs are put in ⁽³¹⁾ and show both for gauge readings and their corresponding discharges in the rising and falling flood that since 1908 or 1912 there has been a well marked postponement of the date of the rise of the flood and a corresponding ante-dating of the fall with an acceleration of the period of the rise and fall.
446. Before 1912 or thereabouts, Indus gauges were considerably upset by the occurrence of a marked trough in average gauge readings, the reasons and nature of which have been discussed in the Bhakra report ⁽³²⁾. This trough makes gauge readings and discharges between 1898 and 1912 unreliable for purposes of this comparison and they have therefore not been considered.
447. The gist of my argument is that we are so close to the shortest period of inundation which will make inundation canals work successfully that any further withdrawals from the river during the critical months, which are June and September, will make the position of the inundation canals very serious indeed.
448. As a matter of fact, their position is already serious. This year the river actually dropped away to practically nothing in September and the inundation canals above Sukkur practically failed. I am not going to base an argument on one year because we all know this has been a very bad year. Below Sukkur also the inundation canals have partially failed during the last three years. I am trying to get out some figures which will apportion the responsibility for this

(31) Not printed.

(32) Report of the Committee of Superintending Engineers from Bombay and the Punjab dated the 15th. December, 1930, on the probable effects of the Bhakra Dam Scheme on the Inundation Canals of the Indus between Mithankot and Sukkur, 1931.

between the three factors which are definitely operative. There is first, withdrawal above Sukkur; the second, withdrawals at Sukkur, and the third, alteration of regime levels in the river. It is a task of some difficulty to separate those various causes, but our experience in recent years is that the inundation canals are just on the edge of failure.

449. The possible cure is another question. I would like to mention that, in connection with this, in order to convert the Fuleli canal, for instance, into a wholly kharif channel, the Bombay Government have spent 37 lakhs of rupees. We cannot claim that this expenditure has been a success yet because the water is not there to begin with. My point is, that in our present position, with our present information, we are not prepared, from the point of view of the inundation canals, to accept willingly any further withdrawals from any of the rivers in the critical months of May and June—June particularly but the second half of May also comes into it—and September and the early half of October, beyond which it is unnecessary for the inundation canals to have water.
450. My reply therefore to ISSUE NO. 5—is that the actual supplies are recorded in the volumes of the Indus River Commission which are printed and are available to all. I have the last two here. One is printed and the other is manuscript. But it seems to me, in regard to our inundation canals, it is not only the available supplies but the available levels which are important.
451. In regard to the question of regeneration between Kotri and Sukkur, there has always been in certain months regeneration in this reach. But this regeneration unfortunately is of no use to us because it is at such a low level that we cannot use it, but there are indications this year that although we might have expected regeneration to be greater, it has actually been less.
452. As regards regeneration as applied to the Barrage canals, as I stated to begin with, my position is somewhat different to that of Punjab. I have no proof that the authorized and available supplies are too small and that we want more water. I am prepared to accept the existing supply.
453. As regards actual requirements, you will notice in the Sind BRIEF that I have made some minor variations—*plus* and *minus*—in several different months, and although we are prepared to stick to the authorized supply, we consider that if there is going to be re-allocation of water, these minor variations might be considered by the Committee.
454. **Chairman:** Can you give us any idea of regeneration between Panjnad and Sukkur?
455. **Mr. Trench:** I haven't the figures handy; I have them in the records.
456. **Chairman:** Has any member any question to ask?
457. **Sir Bernard Darley:** Might I know whether there has been a suggestion to build a feeder from the Rohri canal to feed the Fuleli canal, which will make up for the drop in the river levels due to the Barrage canals.
458. **Mr. Trench:** That is under examination at the present moment. It is rather a serious question because it will entail remodelling or building of a new branch from a place called Oderolal where the Rohri canal divides into branches, and it may entail some remodelling of the Rohri canal above that point. It is also difficult in regard to the way in which supplies could be put into the Fuleli at its head. I may say that the original scheme proposed by Fife in the middle of the last century included the supply of the Fuleli from Rohri. The present situation has been the cause of a considerable amount of agitation in the Fuleli area.
459. I think there is one point I did not mention. You will find graphs appended to the Sind BRIEF for three different gauges showing what we consider the fair irrigation levels for fair irrigation gauge readings at the three gauges which apply to the three inundation canal areas. For the Sarhad gauge we only have averages for four years which are shown in dotted lines. For the Kotri gauge, of course, we have averages for as long as you like—10 year averages, are shown there. The gauge which applies to the Karachi canals or the Lower Sind Delta area is the Aghimani gauge which was recently instituted because we found that the levels did not move concurrently with Kotri. In fact within the last two years there has been a worsening in the Aghimani gauge by $1\frac{1}{2}$ feet as compared to Kotri.

460. As far as our present information goes, those are the minimum gauges below which in any month, May, June or July we are not prepared to accept further withdrawals from the Indus. If it can be shown that further withdrawals from the Indus would not reduce the Indus levels below those points, we would not have so strong a case. There is one further point which may be raised. You will find the fair average gauge reading for the Fuleli in the middle of May is somewhat higher than the average for the last ten years. That is because within recent years the supply previous to May has been practically cut off, and therefore for Fuleli we require actually more water in May than we used to have before, because of the complete absence of rabi water in April. These graphs are somewhat difficult to compile because one low level period in the year may be compensated by a comparatively higher level in another period of the year. I have done it as fairly as I could get them in a simple form.
461. **Mr. Nicholson :** Mr. Trench has talked generally of the inundation canals in Sind both above and below Sukkur. In view of the fact that the Sukkur Barrage has been constructed and a withdrawal of as much as 45,000 cusecs at Sukkur is maintained, the Punjab or any other parties higher up the Indus have no concern with the condition of the inundation canals below Sukkur. As I mentioned previously the necessity for the construction of a barrage at Kotri was foreseen according to Appendix A, Volume II of the Sukkur Barrage Project and the Report of the Committee of two Superintending Engineers of Bombay and the Punjab of 1930⁽³³⁾ in which Mr. Trench has dealt with the conditions of the inundation canals in Lower Sind, and has looked upon the situation as being not unfavourable.
462. As regards the inundation canals above Sukkur, the effect of the construction of the Barrage was considered in that report, as being likely to counteract any deterioration that might be expected to take place, due to further withdrawals upstream, by reason of the consequent rise of water surface levels which would occur upstream of the Barrage. So far, no definite information on this point is available but from the conditions produced in the Punjab by the barrages of the Sutlej Valley Project, accretion of levels above Ferozepur at the junction of the Sutlej and Beas are now definitely established. The North Western Railway Bridge at Giddar Pindi, on the Sutlej above the junction of the Beas has suffered accordingly. It would appear therefore, that the anticipated increases of the level above Sukkur Barrage will also in due course become evident.
463. As regards the question of 3,000 cusecs leakage through the gates of the Sukkur Barrage, I am sorry that Mr. Trench as Chief Engineer is not able to deal with the matter personally because he should be able to rectify this had he been able to give sufficient time and attention to it. Such conditions are entirely unknown and would be unaccepted in the Punjab. It may probably be that the gates are not properly adjusted or the level of the staunching bars are not correct so that when the gates are down they sag slightly. A recent conversation with the representative of the makers of the gates led me to understand that in his opinion, the total maximum leakage should not be more than 100 or 120 cusecs. Experience of more than 100 similar gates in the Punjab has not in any case shown such a leakage. It is not understood why, if a small surplus has passed below the river, the whole of the staunching should have to be replaced. A small surplus can be dealt with by a very few gates.
464. Mr. Trench has also referred to the impracticability of cultivating cotton on inundation canals. A reference to the Punjab statistics for the year 1928-29, shows that on the Chenab inundation canals and the Muzaffargarh inundation canals the amount of cotton was 15 per cent. of the total kharif area.
465. In stating the number of days in which the supply has been short in various months, Mr. Trench has not mentioned the percentage shortages which appears to be a far more important point than the number of days.
466. Mr. Trench stated the number of days in which the supply was short in various months. I think the fact that closures have taken place, indicates that

⁽³³⁾ Report of the Committee of Superintending Engineers from Bombay and the Punjab, dated the 15th. December, 1930, on the probable effects of the Bhakra Dam Scheme on the Inundation Canals of the Indus between Mithankot and Sukkur, 1931.

his demands for water are extremely generous in so much that closures of this length have been possible. Mr. Trench has made reference to the days of shortage but he has not favoured us with a statement of the number of days on which he has drawn supplies in excess of that permissible.

467. **Mr. Trench :** In regard to Mr. Nicholson's point as to how many days the supplies have been in excess of the permissible withdrawals, this involves the definition or the meaning of the "permissible withdrawals", that is to say, is it the permissible average during the month or the permissible maximum on any date in the month? This is important in view of the fact that in certain months there is a very sudden drop between the 30th day of the one month and the first day of the next month and it is impracticable to reduce the supply suddenly by the calendar.

468. **Mr. Nicholson :** In the Government of India Despatch No. 23-P. W., dated the 16th. December, 1920, to the Secretary of State, paragraph 15 reads as follows :—

"The statement No. 1 following paragraph 24 of Volume V of the Project details the maximum discharges, calculated upon the above data that may be required in all canals during each month of the year as follows" from which it appears that maximum is maximum.

469. The Government of India letter No. I.R. 6, dated the 29th. June 1929, to the Secretary to the Government of Bombay, Public Works Department, in paragraph 2 states :

".... I am to say that the Government of India are not in a position to agree to the allotment to the Lloyd Barrage and Canals Project of any supplies in excess of those mentioned in paragraph 15 of our Despatch No. 23-P. W., dated the 16th. December 1920, with which the project was submitted to the Secretary of State for sanction

470. **Mr. Trench** expresses his inability to accept any further withdrawals from the river above Sukkur but he does not hesitate to plead for further withdrawals for himself at Sukkur. I presume that he would not deny to other Provinces those privileges which he hopes to enjoy himself.

471. **Mr. Trench :** It is only on the basis of a revision of the supplies withdrawable by other authorities that we propose to put forward modifications of our withdrawals. On the 3rd. June 1929, the Government of Bombay wrote to the Government of India as follows :—

472. **Mr. Trench** read the Bombay Government letter No. 8255-I. W., dated the 3rd. June 1929. He also read the Government of India reply in letter No. I.R. 6, dated the 29th. June 1929. These will be found at Appendix X, A and B.

473. The point that I wanted to make was that in regard to discharges, they have been dealt with by the Government of Bombay and the Government of India on a monthly basis, the implication being that the monthly average discharge is the basis and not the daily one.

474. **Mr. Foy :** If monthly average is the basis, then that statement of shortages falls to the ground or at any rate needs revision. The basis on which we should frame that statement should be to show the number of equivalent days of full supply run in canals. That will show shortage.

475. **Mr. Sladen :** The Khairpur situation is this. The Bombay Government have agreed to give us an extra supply of 2,000 cusecs so long as their authorized supply is increased *pro tanto*. They have declined to give 2,000 cusecs in rabi unless the authorized supply is increased. In the last three years we have been working under the condition that if the supply falls below the authorized withdrawal, our canals are cut off straightaway before any reduction is made in the British canals. That is why they want an authorized increase to enable us to share equally. The Sukkur Barrage are not asking for an increase for themselves. It is only on our account, and what we ask this Committee for, is an increase of the authorized withdrawals.

476. There is one other point which Mr. Trench made, which applies to us particularly. In most of the Sind rabi canals there is no time factor allowed for. Our canals require a constant discharge of 2,000 cusecs during the rabi season (January

to March), so that the average amount will be the same. In order to work within our duty we should have the canals drawing full supply the whole time. If the supplies available are below requirements at any time then we cannot work within our duty. The two Khairpur feeders each carry 2,000 cusecs and we run them alternately.

477. Mr. Foy : I would ask Mr. Trench whether the inundation canals are purely rice canals.

478. Mr. Trench : Rice and other short period crops like juari.

479. Mr. Foy : Referring to the Fair Irrigation level graphs ⁽³⁴⁾ submitted by Mr. Trench. The total length of time the canals were open was 108 days as against a minimum requirement of 90 days. The date when the Kotri gauge rose to a fair irrigating level was July 16th, and the date when it fell below that level was September 8th, and they had 54 days of fair irrigating supply. I would suggest—this has been the experience on the Punjab—that anything above a fair irrigation discharge is wasted and is a nuisance afterwards.

480. Mr. Trench : Our fair irrigating level is 18·5, but the canals do not all actually run at full supply level when the Kotri gauge is 18·5.

481. Mr. Foy : Taking these figures, the canals had 108 days of sumptuous supply and 54 days of fair supply as compared with 90 and 45.

482. Mr. Trench : The process of planting and transplanting of rice is gradual and extends the period, particularly in heavily cultivated areas.

483. Mr. Foy : With reference to the steepening of the hydrograph on a falling river, is it not a fact that there has been a series of bunds built in Sind ?

484. Mr. Trench : Not within recent years. I think up to 1904, there was an extension of the bund system, but since then the extensions have been small.

485. Mr. Foy : I only ask whether the extension of the bund system would have the result, at the end of the season, that you attribute purely to the conversion of canals.

486. Mr. Trench : It would have the effect of raising the maximum flood.

487. Mr. Foy : Would it shorten the falling river period at any particular gauge ?

488. Mr. Trench : The river comes against the bunds between 12' and 14'. Below that it will have no effect.

489. Mr. Foy : Large volumes of water used to be stored where the river spilled, and it drifted back to the river.

490. Mr. Trench : The ground normally falls away from the bunds and if the bunds were not there, the floods would be dissipated.

491. Sir Bernard Darley : I do not think it is necessary to labour any further the shortage of supply in the Sutlej river. I would do so only to show how such shortage has a bearing on our supplies which we require for the Panjnad canal. The Bahawalpur State authorities have always feared that there would be this shortage which has occurred. At the time the Agreement was signed, the technical officers of the Bahawalpur State drew attention to this shortage which they said would occur, and they also advised the Durbar not to sign the Agreement because of that shortage. The President of the Council of Regency at the time of signing the Agreement, particularly pointed out in his letter of protest, that the Durbar had been compelled to sign the Agreement. He pointed out that in ten years, there would be six years of shortage during the rabi season. Again in the months of April and May he emphasized the shortage, and then throwing himself on the mercy of the Government of India he said :—

492. "To speak plainly, the Council of Regency is doubtful about the sufficiency of water supplies the crucial point on which the utility of the whole scheme turns. As regards supplies we leave the final finding to the benign Government with the request that they will, as the protector of the Bahawalpur State, make sure upon this very serious point and if satisfied, would pass final orders regarding the scheme."

493. The result has come almost as foretold, but somewhat worse. I have before me, the figures which are in Statement C of the Bikaner case. During the past ten years during the rabi sowing period, the average discharge of the river at Ferozepur, has been below the average assumed in the Project during six years. As I have said, during the past ten years, there have been six years in which the average discharge during the sowing period was less than 6,500 the basis on which the canals have been designed. In the year 1934 from the 16th. October to 31st. December the average discharge was only 4,920 cusecs, to which even if you add regeneration water it only gives 5,540 cusecs.
494. I think that every member of the Committee will agree that your average during the sowing period should be much higher than your average for the whole season and that, if you take an average of 6,500 your average during the sowing period should be something in the order of 7,500 and in your maturing period something in the order of 5,500. These two taken together would work out to an average of 6,500. If you will read the discharges in Statement C, you will see in how few years there is anything like an average of 7,500. There may be one year out of ten in which there is this average. It is no use having a large average during the maturing period and *vice versa*. If you have a very high average during your sowing period it is no use having a very small supply during your maturing period. The river appears to be a very jumpy one and therefore my contention is that the average on which the canals have been designed is much too high. I now mention this because it reflects on the discharges which we can draw off at the Panjnad which are tied to these discharges. All this refers to rabi.
495. I pass on to the kharif discharges. I do not know whether it is necessary to mention these because every one admits that they are much less than the discharges on which the channels were designed in the early portion of the kharif and there has been considerable trouble in at least two of the past four years since we brought the full scheme into operation on the Sutlej. If I remember rightly, during May in 1932, the Bahawalpur canals received an average supply of something between 800 and 900 cusecs. Even at the present stage of development, taking non-perennial plus perennial, the canals should draw off about a maximum of 11,000 cusecs. I do not think it is necessary to labour further the short supply during the early kharif season. If the Panjnad canal supplies are made dependent on those drawn off by the British canals in the Gharra reach of the Sutlej, then the Panjnad canal supplies will be restricted to an extent never intended when the Agreement was signed.
496. *At this stage Mr. Nicholson questioned Sir Bernard Darley's statement.*
497. The Council of Regency pointed out at the time of the signing of the Agreement that the supplies would be deficient for the area for which the canals were designed. I am quite convinced that had Sir John Benton and the Council of Regency known the straits to which we would be reduced in the months of April, May and June for many years now, the Agreement would never have been signed.
498. To revert to the Panjnad canal—to tie it to these supplies would almost ruin the country which in the upper reaches at least, is now very fairly developed because of the most efficient inundation system of canals which existed for a large number of years. It is for this reason, therefore, that Bahawalpur complained to the Punjab that a revision should be made in connection with the supplies of the Panjnad canals. All I have got to say is that, if the supplies of the Panjnad canals have to be tied down to those which they can draw-off by the Agreement, those supplies would be totally inadequate, and this has been brought out very clearly in statements I-A and I-B which are attached to the Bahawalpur BRIEF, which show the discharges which the canals could have drawn off during the rabi and kharif seasons respectively during the past 5 years. I have nothing further to say except that these supplies are totally inadequate.
499. **Chairman:** Can you give your opinion regarding those hydrographs of Mr. Nicholson? Do you accept them or not?
500. **Sir Bernard Darley:** I accept them.
501. **Mr. Nicholson:** As Sir Bernard Darley has referred fairly freely to the Project, I would like to refer him again to section 126 of the proceedings of the meeting held at Delhi in December 1919 according to which the project was to be made as defined in Appendix B which made no mention of kharif supplies. There was no reliable data on which they could base the project in regard to the kharif

supplies. The question of supplies available for early kharif crops more especially cotton, is dealt with in Appendix B, and Appendix L. W. (a) page 84 of the 1920 Sutlej Valley Project.

502. **Sir Bernard Darley** : I must apologize if I used the word "project". Mr. Ives' covering note to the Project deals in great detail with these supplies and this covering note has been accepted as part of the project. The Inspector-General, when criticizing the project, used the figures given by the Chief Engineer in his covering letter, and the canals that were designed were based on the figures given in the covering note.
503. **Mr. Nicholson** : The canals were designed according to the decision of the Committee to which I referred—paragraph 126 of the proceedings of the Delhi meeting held in December 1919.
- The project proper begins on page 1 of the Sutlej Valley Project 1920 Report—Part I : General, and then on page 5, Part II : Technical.
504. **Sir Bernard Darley** : You consider that a project comprises only that portion of the officer's report who is deputed to prepare the project.
505. **Mr. Nicholson** : In accordance with the instructions laid down by the Committee, the figures of discharges from 1899 for 10 day periods were collected, but as they were considered not reliable, they were not taken into consideration as they would lead to misunderstandings.
506. **Mr. Trench** : Is it your point that you are prepared to justify the division of water according to the project, in view of the fact that there was lack of information.
507. **Mr. Nicholson** : The conditions of the Sidhnai canal are well known. Sir Thomas Ward said that we should have a canal which was not worse than the Sidhnai. There was no statement in the project as to what would be irrigated.
508. **Mr. Trench** : There seems to be some prognostication as to what the result would be.
509. **Mr. Nicholson** : It could not be worse than the Sidhnai.
510. **Sir Bernard Darley** : It is worse than the Sidhnai in many years.
511. **Mr. Nicholson** : In the Sidhnai in 1934 there was not a single drop till the middle of June.
512. Regarding Sir Bernard Darley's statement that the mean supply in the sowing period is low, Annexure C of the Bikaner BRIEF shows that the mean supply up to the 31st. December is 7,144 cusecs, which appears to be very close to the figure which he stated is necessary. If the sowing period is taken up to the 24th. November then the average for the 15 years comes to 7,630. It is impossible to expect a river of this nature to run steady every year. And so far as the rabi supplies are concerned, there is no shortage on the average below that assumed in the project for rabi.
513. If you will refer to the blue print already submitted ⁽³⁵⁾ showing the irrigation data of the Punjab weir controlled canals other than the Sutlej Valley Project—columns 2 and 3, I think you will get enlightening information regarding the conditions under which we work with complete contentment in the Punjab. The Sirhind Canal capacity is 9 000, the minimum discharge ever recorded utilized in that canal is 2,818, and in 1932-33 it was 3,200. The Upper Bari Doab Canal capacity is 6,250, minimum discharge ever recorded utilized is 1,273 and in 1932-33, 1,700. On the Jhelum river, the capacity of the canals taking off therefrom the Upper Jhelum and the Lower Jhelum canals is 12,700 cusecs and the minimum discharge recorded is 4,000, and in 1932-33 was 4,458 cusecs. In the canals taking off from the Chenab the total capacity is 24,700; the minimum discharge ever recorded has been 3,578, and during that particular year was 4,375. So, if Sir Bernard Darley were compelled to irrigate from these canals, he would find that the conditions were such that he would never contemplate any countryside would be happy.
514. **Mr. Trench** : I would just like to put a question in a general form so as to get some information on what the Punjab point of view is. I should like to put it in this

(35) Data given in Appendix II, (A.)

form : "Is it part of the Punjab BRIEF that the anticipated supplies in the Sutlej River have been realised to such an extent as not to vitiate the agreement arrived at in regard to their distribution ? "

515. **Mr. Nicholson** : Absolutely.

516. **Chairman** : The question of distribution of available supplies is not under discussion, at the moment.

517. **Mr. Trench** : It is rather irrelevant, but I want to get at the general idea.

518. *The Chairman then adjourned the meeting till 9-00 a.m. on Monday 4th. March 1935.*

519. *The Committee met at 9-00 a.m. on Monday the 4th. March 1935.*

520. *The first business of the Committee was to confirm the proceedings of Friday the 1st. March, 1935. After certain errors of recording had been admitted, the record was corrected accordingly. Mr. Sladen then handed in a copy of confidential letter ⁽³⁶⁾ No. 15 dated the 6th. September, 1906, from His Highness Mir Sir Faiz Mohamed Khan Talpur, G.C.I.E., Ruler of Khairpur State, to the address of the Political Agent, Khairpur State, referred to in Proc. No. 61.*

521. *Mr. Sladen also defined "Bosi" as follows :—*

"Bosi is a crop which is sown with the aid of canal waters, but receives no further watering after sowing."

522. **Chairman** : *To Mr. Nicholson.* Will you kindly explain the discrepancy noted in regard to the Pakpattan areas as referred to by Sir Bernard Darley at Proc. Nos. 141/2 on page 12?

523. **Mr. Nicholson** : The figures quoted by Sir Bernard Darley would appear to represent the perennial colony area on the British Pakpattan Canal. A reference to the latest Statistics of Irrigation Water Distribution and Working of Distributaries of the Canals in the Punjab for 1932-33 on page 73 show that for the Pakpattan Canal, the gross perennial area commanded is 1,001,777 acres of which 888,915 is culturable commanded area. These figures differ from those given by Sir Bernard Darley on which the allocation and distribution is based. The figures for the non-perennial portion of the Pakpattan Canal are—

Gross area commanded .. 354,118 acres.

and

Culturable area commanded .. 335,917 acres.

524. These figures, given in the irrigation statistics, represent the actual areas on which the water is allotted and used, as shown by individual distributaries. There has been great difficulty in reconciling the figures of areas in the Irrigation Department records with those given in the Civil Department records, which have differed for many years.

525. *A general discussion followed and the conclusion was reached that, due to difference in practice, the term "allottable area" could not be sufficiently closely defined. The Chairman ruled that the point should not be pursued.*

526. *The Chairman explained to the meeting that the draft ISSUES had been modified and would be distributed in time for the meeting on Tuesday.*

527. **Chairman** : Let us continue from yesterday's discussion. Mr. Foy will explain his views.

528. **Mr. Foy** : The Sutlej supplies in rabi and in kharif are shewn in Annexures A, B, C & D of the Bikaner BRIEF. In my opinion the rabi supplies based on averages are sufficient for the perennial culturable commanded areas of the project as a whole and on an average, reasonably well distributed between the sowing and the maturing periods. Sir Bernard Darley, when commenting yesterday on the supplies, pointed out that there are years of lean supply and, as far as I could understand him, suggested that those supplies and not the average supplies should be taken as the basis on which the project should be framed.

529. I beg to differ from him. In my opinion, it is this over-insistence on occasional shortages which is the root cause of our difficulties in coming to an agreement on

(36) This letter is recorded as Appendix III.

the distribution of the Indus supplies. In America in all their big storage projects, it is recognized that no river flows with absolute regularity and in some of their projects which I have studied, the principle adopted has been to face one year of extreme shortage in ten years rather than incur the very large expense necessary adequately to protect the area against one bad year. Minor shortages are faced and in general, with occasional modifications, the average supply is the basis of design.

530. Reverting to the rabi supplies on the Sutlej it may be of interest to record what the Sutlej Valley Project Committee of Bahawalpur⁽³⁷⁾ has to say on the subject. The relevant remarks are at paragraph 70 on page 23. The Author of the report first dealt with the question of years of lean supply. He then goes on to say in paragraph 71, in connection with the rabi supplies, "On the other hand there are some years of bumper supplies and if the Sadiqia and Bahawal canals were given their full share of the water under the agreement *viz.*, 57% of that entering all canal heads on the Sutlej during those years, they would get far more than they require or would be good for the crops". The paragraph then goes on to make certain assumptions as to the absorption allowance which it is not necessary to touch on at this stage. The final conclusion reads "thus in normal years these two canals could draw off 480 cusecs more than required for the reduced area now commanded and in years when the supply is above the normal, still more." 480 cusecs presumably refers to 480 cusecs of mean supply.
531. Coming to the early kharif supplies, I entirely agree with Sir Bernard Darley that the average supplies are inadequate for the areas and considerably below the data given at pages lxxxii to lxxxv of the Sutlej Valley Project Report 1920. It may be contended that the data were unreliable but I submit that it was on those data that the project was finally based.
532. This is borne out by the conclusions at Appendix L. W. A. page 84, where for the purposes of examining what supplies are available for the early kharif and what can be done with the supplies, the year 1919 was taken as a year "in which the river rose late". If you compare those figures for 1919 with the average figures for the early kharif period, based on the average of the last 15 years as given at Annexure A of the Bikaner BRIEF you will see that this test year of 1919 is 21% above the average of the last 15 years during the relevant periods. Further the effects of the phenomenal absorption losses in the river between Ferozepur and Islam which amounted during April and May to about 20% of the Ferozepur supply were not appreciated. Moreover, at this time of the year variations from average are very marked and the lean years occur relatively frequently, so much so that they do require to be taken into consideration when investigating the adequacy of the river supplies.
533. **Chairman :** Do you wish to say anything, Sir Bernard ?
534. **Sir Bernard Darley :** Mr. Foy has pointed out that in the Sutlej Valley Committee's Report it is stated that, in an average year there would be more water than is required for Bahawalpur and I entirely agree. But he did not point out that the Committee in paragraph 73 said—
535. "It may be suggested that the percentage share of water for Bahawalpur Canals should be cut down because the area to be irrigated has been reduced, but this would be a fatal mistake. The area previously proposed was too large considering the fluctuating nature of the supply available. There will be years when the shortage of water will be very serious even for the reduced area and to cut down the supply in such years would have disastrous effects on the new colony".
536. In spite of all the argument so far, I still hold that the Sutlej river is one of such a fluctuating nature that we will have a very large number of years when we will not have sufficient supplies for our canals. I cannot see how the river Sutlej can change suddenly on the 1st. April.
537. **Mr. Foy :** It is not the river that changes as is evidenced by the discharges, but it is the demand on the river that changes on the 1st. of April, which alters the whole complexion of the case. The demand is suddenly increased from 13,000 cusecs of full capacity or 6,500 cusecs of mean discharge to a figure which is in the neighbourhood of 29,411 cusecs perennial and non-perennial at share supplies.

(37) Report of the Sutlej Valley Project Enquiry Committee, Bahawalpur, 1932.

538. **Sir Bernard Darley :** I think Mr. Foy knows well that in these periods we have not sufficient water in a very large number of years—not even for perennial canals during April and May.
539. **Mr. Foy :** Prior to the 1st. April the demand is for 6,500 cusecs of mean supply and from the 1st. April it is more.
540. **Sir Bernard Darley :** I entirely agree with Mr. Foy that during the months of April, May and part of June there are exceptional shortages in the Sutlej River.
541. **Mr. Nicholson :** I agree with what has been said by the previous speakers that the supply in the Sutlej in the early kharif is not all that might be desired, but the project was specifically prepared to utilize the waters available to the best advantage. There had been a strong inclination previously in the Punjab to increase the kharif capacity of the canals in order to be able to utilize the enormous kharif supplies during that season which passed away to the sea unutilized.
542. When the Sutlej Valley Project was under discussion in Delhi in 1919 this matter was the subject of much discussion and it was decided that the perennial canals should be constructed to a capacity equal to twice the mean supply in the river which is accepted as 6,500 cusecs. For the inundation canal areas, the non-perennial canals were designed up to share capacity with the same capacity at head per 1,000 acres as the perennial canals : but, in order to take advantage of the high supplies available from June to September and compensate for the low supplies available till June, they were given a maximum capacity of 50% over share capacity.
543. At the time, it was fully foreseen that, when the project came to be worked, the people would say that there was no water for the canals. Such a position has now arisen, but it may be pointed out that the resolution by Sir Michael Nethersole at the Delhi Conference of 1919, referred to principles previously laid down, on which the project had to be prepared and it was accepted on the information obtained, that there was ample water to grow maize, fodder crops and rice from June to September. It was never anticipated that a canal system was being constructed which would be comparable to the Lower Chenab Canal or any of the other canal systems. The difficulties that have now arisen were fully foreseen by Sir Thomas Ward as may be seen from his note dated the 3rd. December 1919.⁽³⁸⁾ In paragraph 2 he deals with the supplies available in the rabi: paragraph 3, supply available in the kharif and paragraph 4 rotational working in the kharif. I will venture to read out certain portions of paragraph 4.
544. “I think the conclusion that may be fairly drawn as the result of the investigations made by the Chief Engineer, Punjab, to which I have just referred is that a restriction of supply by rotational working will ensure greater efficiency throughout this vast irrigation system.”
545. “The rotational working on the existing perennial canals starts on a gradually falling river and usually ends in a slack demand when the cold weather rains arrive ; but the hydrographs of the Sutlej river shew that in the early kharif season the effect of the cold weather rains in most years soon passes off and the river remains low till the hot winds reach the snows and then the rise is very sudden to an ample supply.”
546. It may be pointed that the Sutlej Valley Project was designed to utilize, in the best interests of all parties concerned, the supplies actually available in the river. The average rabi discharge of 6,500 was definitely assumed as the basis on which to design a perennial canal system of 13,000 cusecs capacity with a capacity factor of 0.5. The records of discharges in the past were insufficient to give any reliable data as regards supplies available in kharif, and in Sir Thomas Ward's note dated 3rd. December 1919—which was his professional advice before the meetings at Delhi from the 10th. to 14th. December 1919—in paragraph 4 the question of kharif supplies was dealt with, especially sub-paragraph 3. Appendix III shows the data on which he formed his opinion. This Appendix consists of a consolidated statement of discharges actually observed, of which records were available

⁽³⁸⁾ Note, dated the 3rd. December 1919, by Mr. T. R. J. Ward, C.I.E., M.V.O., Inspector-General of Irrigation in India, on the intensities, kharif to rabi ratios, duties, full supply and capacity factors, and gross commanded areas, to be adopted in modifying the Sutlej Valley Project, 1917, to be known as the Projects on the Gharra reach of the Sutlej River, 1919, and the Panjnad and Haveli Weir Projects, 1919.

547. It will be noticed that in sub-paragraph 3 he raises the question of perennial channels continuing to be given a preferential share of the river after the commencement of kharif. But at the general meetings which followed, it was decided by all parties to adhere to a clear change of distribution at the commencement of the kharif crop. The project was submitted to the Government of India in September 1920, and was forwarded to the Secretary of State by the Government of India in March 1921, and it was when dealing with this project that Sir Thomas Ward in his note dated the 10th. December 1920 ⁽³⁹⁾ advised the initiation of daily discharges at several sites in the Punjab, so as to avoid the difficulties which had been experienced in the preparation of this project regarding actual supplies available, arising again in connection with any other question of distribution of water. This note was sent down by the Government of India to the Punjab under cover of letter No. 141 of 10th. January 1921. I think this clearly puts forward the situation as regards supplies for this project.
548. Without wishing to press the matter I take the opportunity of drawing the attention of this Committee to paragraph 5 of sub-paragraph 2 of his note.
549. In Appendix III ⁽⁴⁰⁾ referred to, it will be seen that in 1919 the discharge in April was as low as 3,969 and in May it was as low as 4,081.
550. On the subject of inundation canals it may be stated that on the completion of the Haveli Project the only systems left will be those of Muzaffargarh and Dera Ghazi Khan District from the Indus, and it is not contemplated that any adverse effects will be produced on them by withdrawals upstream from the Indus.
551. As regards the subject of regeneration, I have on a previous occasion, pointed out the nature of the rise of the sub-soil water table on the cross section of the Punjab, and how this increase of sub-soil water table will tend to increase the percolation back into the rivers. Unfortunately we have no reliable data available at the moment to show whether the original regeneration is increasing or not; but there is ample information to show that the regeneration on the Jhelum and the Chenab below Rasul and Khanki down to the Panjnad is far beyond what was anticipated. The Punjab does not make any definite claim that this water is its own water, and therefore not a subject of sharing with other parties as it might do if it took up a meticulous attitude. The completion of the Haveli Project which will introduce more irrigation on the right and left sides of the river above the junction of the Ravi will probably increase the percolation inflow in this reach of the river.
552. The construction of the Thal Canal, should it ever take place, as a perennial canal, and not as a semi-perennial canal at the best, as has been suggested, would further tend to increase the percolation in-flow into the Indus and into the Jhelum. The main line of this canal from Kalabagh to Kundian running alongside the Indus at a high level would be such that percolation losses on the main line would have to return into the main river.
553. The irrigation in the Doab between the Indus and the Jhelum will cause a rise of sub-soil water table which would tend to drain into the Jhelum. The Jhelum has a much flatter slope than the Indus and there is a tendency for the Indus water to pass over to the Jhelum underground.
554. One of the main benefits to be obtained from the construction of the Haveli Project, is that it would be unnecessary for water to be passed below Balloki to the Sidhna headworks for some six months of the year. In this reach of the river, as may be seen from the sub-soil water contours in the plan accompanying the Haveli Project of 1932, there is a definite loss of water, which would be saved. This is the one river in which this consistent loss is marked. On the Sutlej, there is the point which it is difficult to locate, but which varies from year to year, where the conditions of regeneration change from positive to negative. In course of time this point will advance down the river, but at what rate, it is at present impracticable to estimate.
555. **Mr. Trench:** Mr. Nicholson said at the beginning of his statement that the construction of the Thal Project would increase the regeneration of the river. *To Mr. Nicholson.* You are not prepared to make a definite statement?

⁽³⁹⁾ Appendix XXI.

⁽⁴⁰⁾ *Vide Proc.* 546 and footnote No. 38 on page 45.

556. **Mr. Nicholson :** I am quite prepared.

557. **Mr. Trench :** It may be of interest to the Committee to learn, in regard to this regeneration, that there was a very rigid statistical investigation of the regeneration between Mithankot and Sukkur by Mr. Wilsdon some years ago. To arrive at the correlation between the discharges and regeneration, he had to introduce a large number of factors—I cannot remember now what all of them were—but I think they included the rainfall in a diminishing ratio over the previous sixty days. He said in his report that although he produced a correlation from his figures, he did not therefore claim that the two phenomena, that is to say, regeneration and the data that he used, had necessarily any connection with each other. I mention that because it shows how difficult it is to convert any general idea that regeneration will increase into a definite quantitative statement.

558. What it will be at the present moment in regard to the reaches between Sukkur and Kotri, I am not prepared to state. Our regeneration may not have been definitely increased by the reduction in the cold weather discharge of the Indus in that reach. I do not wish to put it more strongly than that because I have not got figures just now in tabular form, but in that reach it can only be a phenomenon which is true of a comparatively limited number of months—I think it is practically January and February. I mentioned, when we began to deal with this subject, that regeneration at Kotri and Sukkur was of no use for irrigation purposes. That does not apply to the reaches above.

559. **Sir Bernard Darley :** The Indus is a very different thing to what Mr. Nicholson is talking about.

560. **Mr. Nicholson :** I do not claim to know what happens below Mithankot.

561. **Chairman :** Mr. Oram, do you wish to say anything on No. 5 regarding regeneration ?

562. **Mr. Oram :** I wish to point out that the Paharpur remodelling and extension will probably increase regeneration. The Paharpur canal remodelling scheme is likely to help, not only as a water economy scheme by using considerably less water than the existing sanctioned capacity but since the proposed extension is not to be further than 6 miles from the river, and from 26 to 60 feet, above the river level, there is likely to be an appreciable return back to the river. The slope from the canal back to the river averages about 1 in 400. The area to be irrigated includes Pod-i-Koi, or flood irrigated areas, and one of the ideas behind this remodelling and extension of the Paharpur canal is to compete with, and replace, this by canal irrigation. If this can be done it will ease the way for a measure of flood conservation.

563. Floods, from the Western Waziristan Hills, flow across the Dera Ismail Khan plain, and into the Indus during July and August when they are not wanted. If these can be conserved by terracing on a large scale, behind the canal zone, this should lead to an addition in the perennial flow in the Indus, as well as some reduction of flood peaks in July and August in that river.

564. Withdrawals from the Indus and tributaries north of Kalabagh, probably have little effect on discharges at Kalabagh since there is an appreciable return to the Kabul river and the Indus, now evidenced by discharges from drains. There is little area on which any further withdrawals can be used. Any such will probably be lift irrigation to the extent of a few hundred cusecs, in the Peshawar district, and possibly small gravity schemes, also of a few hundred cusecs or less, in the Hazara district, on the left bank of the Indus.

565. If it is agreed that such can have no appreciable effect on the supplies available at Kalabagh, it is suggested that it would be unnecessary in future to refer any such proposals to the representatives of other interests on the Indus and its tributaries.

566. **Mr. Nicholson :** I am not directly concerned as there is more than sufficient water in the Indus for the Punjab. The party that would feel any such action in the North-West Frontier Province would be Sind.

567. **Chairman :** When the North-West Frontier Province wish to construct any new scheme, do they address the Punjab Government or not ?

568. **Mr. Oram** : Both the Punjab and Bombay Governments. Bombay have given us an unqualified agreement for the only scheme of any appreciable size which we propose, which would reduce rather than increase withdrawal. It is all a matter of what effect anything further we can do, will have on supplies at Kalabagh.
569. **Mr. Nicholson** : My point is that anything they do is so small that we should not get excited about it.
570. **Mr. Trench** : I do not think the principle is justifiable of any riverain authority extracting water, without the consent of those who have demands lower down.
571. **Mr. Nicholson** : However small ?
572. **Mr. Trench** : Yes. I received a request the other day for 2 cusecs, which was of course reducing it to an absurdity. This question may arise again on ISSUE NO. 10. If the Committee express the view that it will be advisable to have an independent water control officer, then I think it would undoubtedly be useful for any further extractions to be submitted to him, or through him, to the Governments concerned. As the North-West Frontier Province is small, demands are probably small and they are not likely to cause embarrassment, and I think it will probably be a simple matter for them to get the approval of the other authorities concerned.
573. **Chairman** : There would not be many cases as far as the North-West Frontier Province is concerned.
574. **Mr. Trench** : The smallness of the problem makes it easier.
575. **Mr. Oram** : A thousand cusecs would cover the lot.
576. **Chairman** : Gentlemen, I think on ISSUE NO. 5 we have discussed available supplies, inundation canals and regeneration, and the only question now on which we have to arrive at some conclusion is regarding the available supply of water at certain strategic points. Mr. Nicholson has very kindly promised by to-morrow to produce hydrographs⁽⁴¹⁾ showing the discharges for a period of about 12 years, the supplies at Haveli and certain other sites and I suggest that we postpone our final conclusions on ISSUE NO. 5 until tomorrow. Do you agree ?
577. *All agreed.*
578. **Chairman** : I think we ought to revert to ISSUE NO. 4 regarding the definitions of gross commanded and culturable commanded areas—the second part of ISSUE NO. 4. Should available discharges be divided on the basis of gross area or culturable irrigable area ? Do we require to discuss that or not ?
579. **Sir Bernard Darley** : If the culturable area is known and has been calculated on the same basis, then it is obviously better to divide the water on the basis of culturable commanded area.
580. **Mr. Nicholson** : In similarly situated tracts the culturable commanded area would be a more reasonable basis.
581. **Mr. Foy** : I think the culturable commanded area should be adopted.
582. **Mr. Oram** : Culturable irrigable commanded areas.
583. **Mr. Sladen** : I agree with Mr. Trench's definition of the gross area. But actually I find that in the gross irrigable area, I have excluded all land appropriated for any purpose such as villages, roads, canals, and graveyards and the only difference between gross irrigable area and culturable irrigable area, is that the latter comprises the culturable area from the point of view of the soil and only the unculturable land is excluded. My gross area would be bigger than the figures I have given in the statement of areas under command of state canals.
584. **Chairman** : That finishes ISSUE NO. 4. We come to ISSUE NO. 6. At this stage the Committee will examine the general principle—"Should existing canals take precedence over future projects in considering the division of surplus waters found available ?"
585. **Mr. Trench** : I suggest this as a general principle, and I am hopeful that a general agreement will be reached if it is stated more precisely. The idea in my mind was that water requirements which would make an existing scheme productive should have preference to water supply to be hypothecated to a new scheme.

586. I would not, for instance, venture to state that a canal scheme which is already paying, say 10% or 15%, should have preference over any new scheme, but if you get a scheme which is approaching, or has not arrived at, a productive stage due to lack of water supply, then I consider that such scheme should have preference over any proposal. Although I state in those general terms, that is the limit to which I would go. That was really my intention. Some basic line must be adopted and I should lay down that basic line as the return on capital which makes the scheme productive in the technical sense. Beyond that I consider that the principle is so obvious as hardly to require explanation.
587. **Chairman :** Some of the Punjab Canals pay 25%. Would you recommend that their supply should be reduced ?
588. **Mr. Trench :** No. If it is a question of giving such a scheme greater supply in order to get a greater productivity from it, then I would not justify that against a new project, because it is not such a good economic proposition, but if it is paying 4% or 5%, due, not to bad land but to the fact that there was a limited supply of water, then I should say that normally it should have preference over any other.
589. **Mr. Nicholson :** Mr. Trench's proposition seems rather to shatter the foundation of the economic structure. So far action has always been taken as in paragraph 5 of the Secretary of State's despatch No. 76 of the 30th. September 1870:—
590. “The just and liberal view that you have taken, with reference to the benefit to be derived from the Canal works by Native States is undoubtedly correct in principle. The scheme will be the best that can be devised irrespective of territorial boundaries, as was strongly urged by the late Colonel Dyas ; and the Patiala State, while receiving a supply of water in proportion to the area of its land within the influence of the canal, will be expected to pay a fair proportion of the cost. There seems to be every reason to believe that suitable arrangements will be made with the Patiala and other minor Native States which will share in the benefit of the canal, *and that your negotiations will be brought to a satisfactory conclusion.*”
591. I also refer you to Colonel Dyas' views after page 68 at Appendix II, the note dated 15th. August 1919 by Mr. H. W. M. Ives on the further representation of Bahawalpur State.
- “In fine, I am of opinion that Captain Crofton's Project for the irrigation of Patiala can scarcely be improved upon, but I also think that it would probably be worthwhile to ascertain whether a less expensive canal could not be made from the Sutlej River for the irrigation of British territory.”
- “Looking as an Engineer, merely at the question of the employment for irrigation of the water of any river, and assuming that no special reasons exist for irrigating any particular tract, I am of opinion that the best line for a canal is that from which the largest extent of country can be irrigated at the smallest cost irrespective of the name or nature of the existing Government of the country in question.”
- “If a larger extent of Patiala than of British territory can be irrigated from the Sutlej with the same quantity of water at a smaller cost, it would appear to me that the Sutlej was intended for the irrigation of Patiala and I would run the canal accordingly.”
- “Governments are always liable to change, but a properly-made canal will endure for centuries, if not for all time, and every Government is equally interested in its maintenance.”
592. When the question of return on capital is considered as a basis for comparison of claims to water, many difficulties loom large on the horizon. For instance, because one party levies less water rates, are they entitled to more water ? If any other party desires to undertake the construction of a protective work in order to save the tract from deterioration ; in this case there will be no financial return whatsoever, therefore the protective work would have no standing as against another one which was a productive work. I feel that if the financial return be taken into consideration, that Sind should levy water rates on the same scale as the Punjab. If that were done, I think they would find that their financial aspect would become more rosy than they have ever contemplated.
593. **Sir Bernard Darley :** In my opinion if an existing canal has not received sufficient supply efficiently to irrigate the area for which it was designed, then I would give it preference over any other area. Thereafter I do not see why it should take any preference over a new canal.

594. **Mr. Foy :** I agree entirely with Sir Bernard Darley, but the only difficulty is the criterion of efficiency.
595. **Mr. Sladen :** I think the criterion is difficult. Mr. Nicholson quoted a certain letter.⁽⁴²⁾ I think the letter started with "the best system that can be devised" and so on. The question is, what is the best system? Mr. Trench thinks it is the one which gives the best financial return. Mr. Nicholson gives another explanation, he is not very explicit.
596. **Mr. Oram :** Existing schemes should have preference up to a water allowance sufficient for the culturable irrigable area. After that it should not be necessary to consider existing schemes for water distribution of any available supplies. In cases where more than one party is interested in the water yield of any catchment, the water allowance should be either a common water allowance or allowance granted to particular areas as agreed to by all parties interested.
597. **Mr. Nicholson :** I think Mr. Oram's view is quite sound fundamentally.
598. **Mr. Sladen :** I think it is important to consider commitments already existing and not merely the financial aspect of one scheme as against another and in this respect I want to support Mr. Trench. If you compare schemes on a financial basis with due reference to the situation as it exists at the moment of consideration, then Mr. Nicholson's and my case are more or less the same. I think that efficient distribution of water brings the best financial results.
599. *This concluded the discussion on ISSUE NO. 6.*
600. **Chairman :** I will now ask Sir Bernard to open the discussion on ISSUE NO. 7—adequacy of available supplies.
601. **Sir Bernard Darley :** As far as the Sutlej is concerned I think we have said all that is necessary about the adequacy of the supplies. May I suggest that Mr. Foy make his observations first?
602. **Mr. Foy :** I wish to confine my attention to the adequacy of supplies in the Sutlej River. The views I put forward this morning were :—
 (a) that during the rabi the supplies in the Sutlej were adequate for the actual culturable commanded area available as a whole, and
 (b) that the supplies during the kharif sowing period were inadequate for our requirements.
603. Taking (b) first. I consider that the only correct and final solution for the shortage of early kharif supplies is by means of a storage project to eke out those supplies and I consider that this should be taken in hand at once. Until such time as a storage project could mature, it will be necessary to safeguard the existence of the perennial colony canals on the Sutlej by giving them a prior claim to water supply until the discharge in the river rises above a certain figure, which of course must be determined.
604. The actual concrete proposal is put forward in paragraphs 32 and 33 of the Bikaner BRIEF, and is identically on the same lines as the suggestion which was made by Sir Thomas Ward when considering the initial project of 1920. The suggestion is contained in sub-paragraph (iii) at page 2 of his note dated the 3rd. December 1919 which is printed up in the volume referred to by Mr. Nicholson this morning.
605. *Mr. Foy then read the relevant paragraphs.*
606. **Mr. Foy (continuing) :** Examining the full authorized discharge of the project which then was 11,074 cusecs capacity, I suggest the figure of 5,500 cusecs mean discharge with a capacity factor of 0.5. As the non-perennial canals have already been constructed and considerable capital has been sunk in them and as the river conditions are so bad that the figure of 5,500 relating to the canals which utilized these non-perennials would remain closed in many years, the requirements which have been asked for have been lowered to one-third the distributary head capacity plus half the absorption required in the main line as being an absolute minimum.
607. Reverting to the rabi supplies! While the river as a whole is adequate for the culturable commanded area available on the project, this culturable commanded area is now admitted to be owned by the different parties to the project, in very different ratios to the gross areas on which their shares of the river were fixed with the result that one party is suffering shortage while the other has some excess. To obviate these difficulties I suggest that some modification of the percentage shares in which the river discharge is divided during rabi is advisable.

608. **Chairman :** Do you wish to make any definite statement about the proposals ?
609. **Mr. Foy :** I would like to postpone it to a later stage of the discussions.
610. **Chairman :** Let us hear what Sir Bernard has to say about ISSUE No. 7.
611. **Sir Bernard Darley :** As regards the supplies in the rabi season, I do not wish to add anything to what has been already said. As regards the kharif supplies, I associate myself entirely with what Mr. Foy has said. With regard to the quantity of water also, I associate myself with his proposal for the re-distribution of the water at that time of year. It is in effect more or less what we have been doing unofficially during the past two years.
612. Unfortunately, to do anything like this unofficially means inequitable treatment at times and during the past year in order to give supplies to Bikaner, the Bahawalpur perennial canals suffered. For instance, in the case which I have already quoted, from the 20th. April to the 20th. May last year, one branch of the Bikaner canal received 8 days' full running whereas the other branch had 10 days. On the other hand, Bahawalpur had received only $5\frac{1}{2}$ days' full running for its perennial channels. I would welcome therefore any suggestion which would mean that the Bahawalpur perennial canals—in fact all the perennial canals—would be treated alike, and I think that Mr. Foy has found a solution.
613. I disagree with the figures on which he bases the discharge at which he would begin to open the non-perennial canals. If this is accepted in principle the figures will have to be worked out later when we come to consider a more equitable distribution of the water.
614. I notice that on the agenda, we are asked to give the dates when we open our non-perennial canals. I happen to have the gauge books for 1933 and 1934. 1933 was a good year and we opened the Fordwah canal on the 16th. April. 1934 was a bad year and that canal was opened for the first time on the 21st. May. The non-perennial branch of the Bahawal canal was opened in 1933 on the 18th. April and in 1934 was not opened until the 15th. June. These are as far as the Sutlej is concerned.
615. Turning to the Panjnad, Annexures C and D attached to the Bahawalpur BRIEF will show what the state of affairs would have been during the past 5 years had the Panjnad canal been treated as it could have been treated under the Agreement, both during the rabi season and the kharif season. During the rabi season, in good years the supply would have been reasonable, but 1931-32 was a bad year and again in 1933-34 just as on the Sutlej and in those years the perennial section of the Panjnad canal would have suffered very severely.
616. During the kharif season it would have been in exactly the same state as the canals taking off the Sutlej during the early kharif. We could not have opened the non-perennial channels last year, until some time in May or June just as the Fordwah canal and the non-perennial branch of the Bahawal canal were not opened until the dates already mentioned. This would have had an adverse effect on our cotton area which is expanding at a very great rate on the Panjnad canal because the country is particularly suited to the cultivation of American cotton. I have already given in the BRIEF, the rate of expansion of cotton simply because, due to the kindness and consideration of the Punjab and Bombay Governments we have not been restricted so far.—

Cotton area in 1932	..	..	..	..	..	23 000
Cotton area in 1933	..	..	..	..	..	48,800
Cotton area in 1934	.	..	..	..	..	86 700

617. With the rise in the price of cotton, people this year, are preparing to extend the cultivation still further. We trust that the Committee will recommend something which will enable us to carry on the good work and make this one as a paying section of the Bahawalpur canals. To enable this to be done, as I stressed yesterday, I would ask for the concession which the Bombay and the Punjab Governments (Chief Engineer, Punjab) have permitted for the last two years, namely, that the canal should be allowed to remain open from the 16th. October to the 31st. October on the condition that it is not opened until the 15th. of April.
618. It would help us enormously because cotton appears just as in Sind, to be sown very late in this area and pickings go on right to the end of January. Therefore a watering in October appears to be essential. If cotton is given this watering, it

interferes with the watering which is so essential for keeping up a rabi area. Therefore the two seasons overlap. If it were possible to keep the Panjnad canal open until the end of October, we would be able then, to give the necessary waterings to enable the people to sow their rabi.

619. **Mr. Trench :** I should like to make my remarks on a rather different aspect of the case. Our position in regard to the inundation canals has been for the last 2 or 3 years a very serious one. I was reading in the paper that under the Karachi canals area during the last three years, remissions have been made up to half the total assessment. That was not all due to lack of water—some of the special remissions were due to collapse of prices but by no means all.
620. We are perfectly aware in Sind that any deficiency under present conditions in the kharif in the inundation canals, is a matter with which we have to content ourselves because the Government of Bombay have been a party to the withdrawals which have already taken place. What will happen to these canals if further withdrawals take place within the kharif periods (which I may say vary with the canals, in some of the big canals it begins from the 15th. May and in medium sized canals from the 1st. June), is a matter for further consideration.
621. The second critical period is between the middle and end of September. Now these two periods are inter-related to a certain extent because if we do not get an early river it can be compensated for by a good late river and a good early river will reduce the demands for late waterings, but before the 30th. September we must be able to get water to mature rice crops.
622. I have taken out a statement⁽⁴³⁾ showing what the fall in the Kotri gauge would be for a specific reduction in discharge. I have taken the discharge of 10,000 cusecs and within that amount and close about it the reduction would be proportional for other discharges because the hydrographs are nearly straight for short lengths. If there is a loss of 10,000 cusecs when the river is low, say 4' at the Kotri gauge, that makes a difference in the level of 2.3'. At a height of 6' a loss of 10,000 cusecs makes a difference of about 1.9'. To work this out I have taken 5,000 cusecs on each side of the gauge reading. When you get to a gauge of 20' at Kotri the loss of 10,000 cusecs makes a difference of 0.2 in gauge.
623. The average gauge reading for the last 10 years of the Kotri gauge on the 1st. June was about 11½'. You can take it at 12' and at 12' the 10,000 cusecs reduction will make a difference of 0.7' in level. The graphs which I have here, show that a reduction of level of 0.7 in gauge will cause the same gauge readings to occur roughly 5 or 6 days later.
624. Again at 16' on the Kotri gauge the reduction is 0.5 and that will make a difference of 5 days. Later on, when it gets up higher, a difference of 0.2 will probably not make a difference of more than 1 or 2 days. Similarly on the falling river at 16'—17' a gauge of 0.5 will make a difference of about 4 days. These may seem very small differences to those who are not used to inundation canals, but as a matter of fact they are of vital importance in every year except in an exceptional good year. This year when the river fell away early—as everybody knows—the effect on the Fuleli canal was such that one more watering would have saved a large part of the rice crop. The loss of 5 or 6 days at that period would be a very great hardship to the cultivators.
625. I mention this to show how very vital these small number of days are, in regard to the inundation canals. I have not got a summation of the claims of water on each day, but when that comes to be worked out it will be easier to evaluate what the exact effect on the level of the river would be from the point of view of the inundation canals.
626. The question of the date on which the inundation canals are open and closed : from the Indus River Commission Reports October 1931, it will be found that, except for the Eastern Nara which is in fact perennial, there were no inundation canals open above Sukkur before the end of May with the exception of 2 canals in the Bahawalpur State. I am talking of Sind canals. In general the larger canals begin to open, and 2 of them are opened, on the 1st. of June, one with a very small discharge of 200—300 cusecs and another opened with 700 cusecs. The opening of the various canals progressed steadily until the last one, a small canal, was opened on the 24th. June.

(43) Not printed.

627. Between Sukkur and Kotri the question of inundation canals does not arise. Below Kotri, there is the Hasanalli canal which was opened in May with a small discharge and there is the Baghar canal which actually did not have much discharge before June. The other canals were opened in succession until you come to the smallest canals which did not open until the 29th. June. We may say that the inundation canals in Sind do not open before the 1st. of June.
628. One canal, the existing conditions have hit particularly hard, is the Fuleli canal. It used to be practically perennial and it is not now perennial. It is not a modern canal but an old one. The whole of the existing system of cultivation has been upset on that canal by the postponement of water supply till June. This has already caused grave dissatisfaction. As I said before, the conditions which have already arisen are the concern of the Bombay Government and we cannot alter them. But it is of the greatest concern to the Bombay Government to see that any action in the higher reaches of the river does not make the position which is now bad, worse.
629. As regards the days of closure, we have had, out of 3 successive years, 2 years in which the water supply at the end of the year has failed, *i.e.*, years 1932 and 1934. 1933 was a good year as regards the ordinary inundation. In 1931, according to the records which I have here a certain number of canals ceased flowing in the middle of September. The Desert Canal was a large canal which continued to flow, but with the exception of four canals they all ceased to flow by the middle of October. Generally speaking, if we have an adequate early water supply in the inundation canals, it is not essential to have the supply after the 15th. October.
630. *The tables of the Indus River Commission 1931 were referred to by Mr. Trench for the figures given above.*
631. **Mr. Sladen :** With regard to Khairpur, the available canal supplies are inadequate because the authorized supplies are inadequate. The supplies are for 9 months, April to December. They are inadequate, not because there is a shortage in the river but because Bombay did not allow us a full share of the benefits of the Barrage. I may say that ever since the barrage was built, the Bombay Government have allowed us a provisional supply of water in the three months of January, February and March. No attempt has been made by the Bombay Government to explain or justify the change in the two schemes of 1909 and 1919.
632. According to the 1909 scheme, we had a rabi supply. I am convinced that the Khairpur demands *vis-a-vis* Bombay are very reasonable. If you consider dispassionately how the Khairpur Durbar had been treated by the Bombay Government, I think you will agree that it was unfair treatment. The British canals have been taken through the middle of the State and yet the State is not given a full share of the benefits of the barrage. This in itself is a good reason why the Bombay Government should give Khairpur special treatment. But instead of this, the Bombay Government said that they would give such supplies as they thought proper and adequate. So far we have no agreement at all with the Bombay Government. What we want now is merely a supply of 2,000 cusecs during the maturing of the rabi crop.
633. **Chairman :** Is that the mean or the maximum ?
634. **Mr. Sladen :** -Mean, on the basis of those three months. That 2,000 cusecs asked for is less than 10% of the Sukkur Barrage authorized discharges which vary from 23,000 to 24,000 during that period. Giving us that supply should not seriously affect the Barrage scheme as a whole. However, we do not insist that we should be given 2,000 cusecs from the allotment of the Bombay Government. We are willing to allow Bombay Government, to try and get the authorized supply increased by 2,000 cusecs and take our share in that increased authorized discharge. We are also willing to reduce our present authorized discharge in certain months—in April and May and November and December if we are given rabi mean supply of 2,000 cusecs during January to March. During the last three years we have had a discharge of 2,000 cusecs during the above three rabi months, and the supplies have proved perfectly satisfactory. We have found that there has been sufficient water for us as well as for the Sukkur Barrage Project.
635. With regard to the rest of our case before this Committee, if more withdrawals are allowed higher up, I think Mr. Trench has shown that there is a grave danger to supplies at Sukkur in the precarious months of February and March. But relying on our experience of the last three years, I have no objection if the Committee recommends that the existing provisional arrangements during the last three years

are made permanent, because we have not suffered thereby, and I do not think the Sukkur Barrage has suffered either.

636. **Mr. Oram :** As regards inundation canals, the waste of water allowed to run to the sea, in order to maintain levels from which inundation canals may draw supplies for irrigation, amounts to lakhs of cusecs during early and late kharif periods when water is scarce. It seems wrong that schemes for irrigation development, in areas where some or all, of this water could be efficiently used, should be postponed or modified out of consideration for these inundation canals. If there is no protest made against consideration for inundation canals, it may continue. So long as there is little or no difficulty in obtaining inundation supplies, it is unlikely that much will be done to cater for them by linking them to weir controlled schemes, or providing special weirs for them. It is, therefore, suggested that this Committee should recommend that in preference to postponing or modifying proposals for using water efficiently, inundation interests, likely to suffer from these, should be catered for by linking up with weir controlled schemes or by providing separate weirs for them.

637. **Mr. Trench :** At the cost of the people who want extra water ?

638. **Mr. Nicholson :** It is a great pleasure to me to see that certain members have used the word "inadequate" instead of "shortage" in connection with supplies for certain canals.

639. As regards the date of opening of inundation canals, it is rather interesting to refer to Appendix II of Sir Thomas Ward's note dated 3rd. December, 1919 where it is seen that the Sidhnai canal was opened in 1908 on July 12th. and in 1916 on June 22nd. This shows that conditions are extremely bad on some canals of which people are not aware of the actual working conditions. The inadequacy of supply in the Sutlej in the early kharif can be overcome in two ways :—

(i) by storage, as suggested by Mr. Foy,

and

(ii) by the utilization of natural flow water, not in the Sutlej, but in other rivers. In the Punjab BRIEF, in the last paragraph, the memorandum refers briefly to proposals which would reinforce the supplies from the Sutlej by switching over supplies from the Ravi and the Chenab.

640. Since the Sutlej Valley Project was undertaken, the Bhakra project has been under re-consideration. On the advice of Mr. A. J. Wiley, Consulting Engineer to the Reclamation Bureau of the United States of America on High Masonry Dams, we propose to increase the storage capacity from $2\frac{3}{4}$ million foot acres to $4\frac{3}{4}$ million foot acres which would make the desired supply available on the Gharra reach of the Sutlej, until the capacity of the reservoir decreases and makes a separate storage on the Beas necessary.

641. Were the Bhakra Dam Project undertaken at a relatively early date, then all anxiety on the Sutlej Valley Project will be alleviated. It is possible that the utilization of water switched over from the Beas to the Sutlej could be undertaken, by mutual agreement, to be equivalent to "stored water", so that it might be utilized under the clause of the agreement having reference to stored water ⁽⁴⁴⁾.

642. Regarding the date of 15th. October for the closing of non-perennial canals. I would suggest that it is desirable to maintain a uniform practice on the upper reaches of the rivers, and leave the question of any supplies which may be available after that date to be dealt with separately, so as to avoid having different basic principles in connection with different canal systems. Any idea of allocating water definitely after the 15th. October should be entirely dependent on its being surplus in the river beyond the requirement at Sukkur.

643. The issue again arises as to what, if any, responsibility attaches to canal projects upstream of Sukkur in regard to inundation canals above Sukkur. It has been, I think, accepted that with the construction of the Sukkur Barrage all parties above have been relieved of responsibility for supply of canals downstream as far as Sukkur.

644. It would appear from what Mr. Foy has indicated, that the point foreseen by Sir Thomas Ward in December 1919 regarding the difficulty of sharing water in the

(44) "Terms of Agreement subject to the confirmation of the Secretary of State in Council between the British Government and the Governments of His Highness the Nawab of Bahawalpur and His Highness the Maharaja of Bikaner regarding the irrigation of the tracts commanded and economically irrigable from the Gharra Reach of the Sutlej River and from the Panjnad Reach of the Chenab River."

Clause 34. "If at any time it is found desirable for the more efficient working of the canal system to store water on the Beas it shall be optional for the three parties to share the cost of the storage in proportion to the benefits to be received by them"

early kharif has arisen, and it is possible that a solution to that problem might be secured by the parties sharing the water, reducing or increasing their supplies at one time and taking more or less later on during the season so as to adjust shares within the period. This, however, is only an indication of a possible method of overcoming the difficulty without making any drastic changes which would affect the agreement.

645. **Mr. Trench :** I would like to make it clear that the Bombay Government did not admit that the construction of the Sukkur Barrage frees upper riverain authorities from responsibility in regard to the canals below Kotri. There was some difference of opinion on this very point in the instructions issued to us, when Mr. Nicholson and myself were considering the Bhakra Dam Report. The Government of Bombay claimed that that report should cover the conditions in regard to inundation canals above Sukkur and below Kotri. The question was never finally decided, but a note which I wrote in regard to *infra* Kotri canals was subsequently bound up as part of the report, and it is of such a nature that Mr. Nicholson was also able to accept it.
646. **Mr. Nicholson (To Mr. Foy) :** It is suggested that the dates of opening and closing of non-perennial canals should be uniformly 1st. April and 15th. October unless there is any reason to the contrary.
647. *The Chairman adjourned the meeting till 9-00 a.m. on Tuesday 5th. March 1935.*
648. *The Committee re-assembled at 9-00 a.m. on Tuesday the 5th. March 1935.*
649. *The first business of the Committee was to confirm the proceedings of Saturday the 2nd. March, 1935. The record was corrected where necessary by mutual consent.*
650. *At the request of Mr. Trench the following explanation was added to Proc. No. 272, page 22 :—*
"That is to say on mean supply during the whole base period of 183 days".
651. **Chairman :** Gentlemen, I suggest we start with ISSUE NO. 8 regarding the Haveli Project.
652. **Mr. Nicholson :** With reference to yesterday's remarks about the adverse effect of proposals for further irrigation in the Punjab on the Inundation Canals below Sukkur, the report of the Indus Discharge Committee, 1929, page 4, para. 16, appears to clear the situation. This shows that the Indus Discharge Committee accepted that Sind could not claim any adverse effect on Inundation canals below Sukkur, as the draw-off which occurs due to the Barrage was of considerable magnitude. It may be noted that this decision was that of Irrigation Officers including the Chief Engineer of Bombay and the Consulting Engineer to the Government of India and is that of the highest technical opinion available.
653. **Mr. Trench :** I do not consider that that decides the issue, because my recollection of the meetings of that Committee is that the general question as to whether the upper withdrawals in the Punjab would affect the lower Sind Canals, or not was not discussed. I wish to say that it is not the interpretation which, apart from myself, is accepted by the Bombay Government.
654. **Chairman :** Can you quote any reference or not ?
655. **Mr. Trench :** I am speaking on the general case from my recollection.
656. In connection with the Bhakra Dam Enquiry it was definitely laid down by the Bombay Government that I, at any rate, should discuss the question as it affected the lower Sind Canals. Apart from the question of the decision there, I do not think it is a proposition that anybody can maintain on its merits.
657. The whole contention as between the Punjab and the Bombay Governments on this particular point as based on the fact that in a letter, No. 4184-EI, dated 1st. April 1930, from the Secretary to the Government of Punjab, Public Works Department (Irrigation Branch) to the Accountant General, Punjab ; he says : " I am directed by the Governor in Council to convey sanction to make a joint investigation into the effect of the Bhakra Dam scheme on the Sind Inundation Canals with an officer deputed by the Bombay Government ". We interpret it as being the whole of the Sind Inundation Canals and the Punjab interpretation is the Sind Inundation Canals specially mentioned in the Indus Discharge Report.
658. **Mr. Nicholson :** I do not think a communication to the Accountant General can have any weight.

659. A blue print ⁽⁴⁵⁾ was put in previously in response to a request from the Chairman showing the data regarding Haveli, and Thal projects.
660. Accompanying the memorandum of the Punjab, was a statement showing the details of gross areas within the irrigation limits of the Haveli Project. In the blue print the culturable irrigable area is that left, after making deductions from heretofore unirrigated area of land which, as a result of Dr. McKenzie-Taylor's surveys, has been considered to be irrigable at the present time without undue expense on reclamation, that is to say, alkaline soils have been excluded.
661. The irrigation load on the Chenab and the Jhelum has resulted in the whole supply being utilized above Rasul and Khanki weirs for the greater part of the rabi season. The Haveli Project will have to rely for its supply on regeneration below Khanki and Rasul. It is not proposed to ask for a supply for the perennial portion of this project at an unreasonably high rabi capacity factor, because, were this done, and the whole rabi crop matured on canal irrigation water alone, the wells would go out of use. It is essential to pitch the supply of water to be utilized in such a way that these wells will be worked.
662. On the blue print tabled, ⁽⁴⁶⁾ showing for the weir controlled canals on the Jhelum and the Chenab above Trimnu the mean monthly draw-offs, and capacity factors, a statement has been given at the bottom, which shows that with a canal capacity of 2,750 cusecs, full supply is proposed to be run up to the end of November, which will ensure the largest possible area of rabi being sown.
663. As soon as the sowing period is over, for the months of December, January and February a mean supply of 825 cusecs only is asked for, that is to say, a capacity factor of 0.3. This water will be insufficient to mature the large area of rabi put down and will necessitate working the wells during this period, which will control the sub-soil water table. During the month of March full supply is again asked for, as this will give valuable water to the whole wheat area just at the time when the milk is running into the grain, the greatest outturn available will be obtained. This will further give the cattle a rest from working the wells from February to the beginning of April, so they may be in good condition to undertake the kharif sowings. At the present moment in a bad rabi year, when the rabi crop has matured, the cattle have been so over-worked that they cannot efficiently plough for the kharif crop: even if supplies are available in the Ravi.
664. The present inundation canals in this area will be supplied with non-perennial water at the usual allowance of 6 cusecs per 1,000 acres. The perennial area will be supplied with a canal head capacity of 4 cusecs per 1,000 acres. From the hydrographs put forward ⁽⁴⁷⁾ it will be seen that supplies in the Sidhna Canal under existing conditions are more than precarious at times, and any one who does not know the locality and the benefits it receives from wells to tide over periods of bad supplies, will wonder how such a canal system could be efficiently run with material benefit to cultivators.
665. The condition of supplies and the water utilized in the Multan Inundation Canals are shown in the hydrographs put forward, in which supplies utilized in the past are shown with conditions that would have held had the project been completed. Even if water were available, we would not propose to attempt to convert the area on the inundation canals into a perennial irrigation area. We realize the fact that although extra revenue might be obtained for a short time, it will mean the destruction of the country side.
666. This is an example of how we see eye to eye with Bahawalpur in refusing perennial irrigation to khadir areas. The kharif full supply factor is 70 acres per cusec as on other projects, that is to say, at distributary heads. At canal heads it is about 58. This water allowance is the same as that on the British canals of the Sutlej Valley Project. The rabi duty, however, has been increased from the normal of 210, at distributary head to 280, an increase of 33 per cent., due to the fact that low supplies are being run for three months and irrigation will be supplemented by wells. The duty of 280 at distributary heads will mean 5/6ths of that at canal head, that is, 234 at the canal head.

⁽⁴⁵⁾ Data given in Appendix IV (B).

⁽⁴⁶⁾ Plato IV.

⁽⁴⁷⁾ On record in Central Board of Irrigation Office. (P. 93-98).

667. As regards the rabi supplies the hydrographs put forward the other day, show that supplies at Trimmu are adequate for this purpose, taking into account the fact that we have to fulfil the conditions of 1920 Agreement of maintaining a mean supply of 516 cusecs for the Abbasia canal lower down the river.
668. This amount for the Abbasia canal is obtained by percolation below Haveli which will probably increase after construction of the Haveli Project as there will be more irrigation on both banks of the river and the water surface at the river in the rabi season will be lower, which connotes a greater inflow into the river. 516 cusecs is the mean supply which is drawn off the Abbasia canal at the Panjnad headworks. It may be noted that the effect of clause 4. D. 2 of the 1920 Agreement, would be to place a certain amount of restriction on the Haveli Project but is such that it is faced with equanimity. This amount of 516 cusecs is based on the proportion between the supply utilized on the Sutlej in the perennial canals and their full supply. It is on this analogy that the water will continue to be supplied and it is owing to these conditions, as I mentioned above, that the Sutlej is loaded highly relative to the Chenab.
669. **Chairman :** *Note recorded after some discussion.* 516 cusecs represents 50 per cent. of capacity and is a figure aimed at in the project, based on averages. It bears no relation to the rabi supplies which will be delivered to Abbasia perennial canal which will be controlled solely by the proportion existing in the Sutlej for the canals taking-off the Gharra reach.
670. **Mr. Nicholson :** The Discharge Committee agreed that a maximum supply of 1,250 cusecs could be withdrawn for the Haveli project. In their 1929 Report, on page 4, paragraph 14 reads—
 “This supply should be limited to 1,250 cusecs during the winter months from the 15th. October to the 20th. of April”
 At that time, it was assumed that this was the mean supply, as to have a constant supply the whole time has never been the practice in the Punjab. Unfortunately, the word “mean” was not stated in paragraph 14 as quoted, but later on in the end of it is recorded “the volume which we have suggested is the maximum to be withdrawn”. It has, however, been held technically to mean that no more than 1,250 cusecs can be withdrawn on any one day.
671. This discrepancy was unfortunate and was discovered when the minutes were circulated for signature. Demi-official correspondence took place in which it was accepted that the error was unfortunate and would be rectified at the next meeting of the Indus Discharge Committee. Owing, however, to the abolition of the post of Consulting Engineer to the Government of India no further meeting has taken place.
672. *Asked by Mr. Trench, Mr. Nicholson replied that the demi-official correspondence was between Messrs. Smith and Harris.*
673. Under the present proposal, the mean supply through the rabi will be 1,700 cusecs as against the maximum of 1,250 cusecs already sanctioned. The minimum now asked for, however, will be 825 cusecs (this being the mean figure) over a period of 3 months during the period of short supplies.
674. The withdrawals for the Haveli Project are very small and it would be difficult to trace the effect at Sukkur except by very abstruse methods of statistical analysis. In any case, it may be pointed out that the non-perennial canals replace inundation canals of a total capacity of 6,983 cusecs together with the Sidhnai canals of 2,656 or a grand total of 9,639 cusecs. The total capacity will now be 7,750 cusecs or a decrease of about 2,000 cusecs in all.
675. **Sir Bernard Darley :** First of all, I should like to put forward the fact that the new perennial area which it is proposed to irrigate on the tail of the existing Panjnad Canal is very different in character to that described on the Haveli Project. There we have no wells, or practically no wells, and the water for the most part is so brackish that it is unfit for drinking and therefore it would be quite impossible to go down to such a low capacity factor as proposed by Mr. Nicholson for the 3 months December, January and February.
676. **Mr. Nicholson** has proposed that Bahawalpur should be guaranteed the supply which it can draw off under the Agreement. This supply would work out at 516

cusecs over a number of years but in bad years it would be very much less than this. For instance, if you turn to Annexure C attached to the Bahawalpur BRIEF you will see that the supply which it would have drawn off, say in the month of March 1932, would only have been in the order of 0.25 capacity factor and in the month of March 1934, it would have been of the order of 0.35 capacity factor under the Agreement. One of the reasons why this Committee was formed was that we asked that the supplies should not be limited to this extent under the Agreement.

677. Mr. Nicholson does not hesitate to ask that the supplies by which the Punjab is limited under the Agreement should be altered in his case and therefore I think that Bahawalpur can equally ask that its supplies should be treated in a like manner. Bahawalpur has therefore claimed that when the Haveli is built, Panjnad, both perennial and non-perennial, canals should be treated on exactly the same basis. If, as Mr. Nicholson claims that he should get 4 cusecs for 1,000 acres of gross area for the Haveli perennial canal then Bahawalpur claims that it should get 4 cusecs per 1,000 acres for its proposed perennial area. That would work out at a maximum head discharge of 1,676 cusecs but the perennial canals have been designed to take only 1,032 cusecs. Therefore, it would have to have a considerably higher capacity factor if we were to work on the 1,676 cusecs against the canal which was capable of taking 1,032 cusecs. Similarly, for the non-perennial canal if we were to get a discharge of 6 cusecs per thousand acres as demanded for the Haveli project, we would get a discharge of 6,096 cusecs as our full capacity. Bahawalpur asks, therefore, that it should be treated on exactly similar lines as the Haveli Project.

678. Now to come down to the particular! If we take the figures for the rabi season, Annexure F attached to the Bahawalpur BRIEF shows that, as Mr. Nicholson has stated, in almost every period there is sufficient regeneration to give Bahawalpur all that is required for its perennial canals throughout the season. It is only in exceptional circumstances that the full requirements of Bahawalpur cannot be met from regeneration water between Trimmu and Panjnad. I quite agree with Mr. Nicholson that this regeneration will increase, but one never knows what will happen, and Bahawalpur would like an assurance of this and will therefore ask that if at any time it became necessary, the water should be shared in a fixed proportion between the Haveli and the Panjnad in proportion to their areas.

679. I now turn to the kharif figures, Annexure G, I have only got four years. From this it would appear that there would be ample water both for the Haveli and for the Panjnad perennial and non-perennial canals after the 21st. April and there is water to spare after that date. Therefore, we may assume that in the early kharif there will be no difficulty about providing water as far as the river discharges are concerned. It is only in the month of October that difficulties may arise. In the year 1932, the river at Panjnad dropped down to 1,860 cusecs from the 11th. to 20th. October. That figure I cannot vouch for; it was taken from a certain number of the Indus Bulletins from which figures for some odd days were missing, and I would like Mr. Gunn to give us the exact figure.

680. On 7th. March, Mr. Gunn distributed a corrected statement ⁽⁴⁸⁾ to be substituted for that attached to the Bahawalpur BRIEF.

681. Similarly, in that year, at the beginning of October there were only 6,729 cusecs at Panjnad. In the middle of October 1934, there were only 9,180 cusecs at Panjnad. The full requirements for both Haveli and the Panjnad canals would be in the neighbourhood of 15,000 cusecs, 7,500 cusecs for them and something of the same order for us. From this you will see that in the very dry years there will not be water in the river during the month of October to give full supply to both canals and therefore, I say that it should be divided in proportion to our areas. That is all I have to say and I would emphasize once more that Bahawalpur wish to insist that the Haveli and the Panjnad are treated exactly alike as regards any supplies which are allowed to be drawn from the Chenab river.

682. Mr. Trench: I wish to say something on the question which Mr. Nicholson has raised as to whether the original figure of rabi discharge for the Haveli project should be considered as a maximum or mean. Mr. Nicholson has informed us that after the meeting of the Indus Discharge Committee it was discovered in the

Punjab that that figure which was stated to be or used as a maximum, had been intended to be a mean. As far as the Bombay Presidency is concerned, we regard the figures of discharges as the maximum, that is to say, that we speak of the discharge of the canal in the rabi season and that we are thinking of the maximum discharge of it. It was certainly distinctly understood in Bombay that that discharge was to be our maximum liability as it were.

683. That withdrawal of 1,250 cusecs was looked upon as something which we could agree to as being the maximum withdrawal during the rabi season. Of course, it is difficult to say what would have been the decision or what would have been the attitude of the then Chief Engineers and technical officers to the Government of Bombay, had that figure been increased to 2,750. But I have no hesitation in saying that it would have caused the technical advisers to the Government of Bombay to look at it with alarm and doubt, and it would have been subjected to far more detailed criticism than the original figure of 1,250, which we understood, rightly or wrongly, to be the maximum.
684. Mr. Nicholson has mentioned that in his opinion the withdrawal of this amount of water would be very difficult to trace at Sukkur definitely. I am not prepared to contradict him. But I think it would be quite possible to trace it over a number of years, that is to say over a long period, by comparing the normal discharges at Sukkur with what would be received after that withdrawal had been made. When we were investigating the possible withdrawals due to the Bhakra Dam proposal, we found that in the cold weather months at Sukkur, that is to say the time of minimum, there would appear to have been a comparatively small reduction in the discharges taken over a long period compared with the known additional withdrawals that had been made in the Punjab during those months.
685. I consider however, that that does not apply to the more recent years since the Sutlej Valley Project has come into being. The graphs which I have of more recent years in the cold weather months, do exhibit a marked downward trend. The reason for that marked downward trend is that, whereas the withdrawals in former years were a long way further from Sind than the Sutlej Valley Project and the Haveli Project also, the effect of the Sutlej Valley withdrawals has been proportionately more marked than the effect of the former withdrawals which took place further away and higher up.
686. In other words, those former canal head withdrawals allowed more time and more length for the regeneration which undoubtedly took place. So far as the Haveli project is concerned, the Bombay Government is concerned only with the difference between 1,250 and 2,750 which is now proposed as a maximum rabi withdrawal, that means to say 1,500 cusecs. As I said before, I doubt if it is possible to put into figures, the ultimate difference which would occur at Sukkur, but I am not prepared to accept as a fact that there would be no difference. If, on the other hand, this increase or this proposal to construct the Haveli Project led to further withdrawals by the Bahawalpur canals, that would also affect the question vitally. One would have to base one's opinion on what the total withdrawals would have to be.
687. There is just one question I would like to ask Mr. Nicholson and that is whether this canal is calculated to be a productive proposition or whether the Punjab Government propose to face any loss as against their general revenues for the benefit of this area.
688. *The Chairman disallowed the above question on the grounds that it was based on finance.*
689. **Sir Bernard Darley :** Regarding shortages in the river during the last few years, do you not think that this was partly due to the low river supplies which undoubtedly occurred in the Punjab during those years ?
690. **Mr. Trench :** That is why I stated that you can only trace effect over a very long term. It is quite possible that these may be exceptional years and until we take a long term and record the effects it could not be decided. Take the January discharge graphs at Sukkur ! When we were investigating this question, 1929-30 was the last year. If you will exclude the last 3 or 4 years you will observe that

there has been comparatively a slight downward tendency of the averages during that month. If you include the last few years you will find that there has been a very much steeper downward trend.

691. **Sir Bernard Darley :** Is it not probable that this is due to a series of dry years ?

692. **Mr. Trench :** This is a matter of argument. You could attribute it to climatic variations or some abnormal conditions.

693. **Mr. Sladen :** I think that the mean supply of 825 cusecs in January and February would not have any significant effect on the Sukkur supplies ; but in the beginning of March it might be possible for them to postpone the increase for another week or ten days to the time when the Sukkur channels will be closed.

694. **Mr. Trench :** The Sukkur channels are closed from about the middle of March to the end of March.

695. **Mr. Foy :** I would like to draw a comparison between the proposed Haveli Project and the present Bikaner canal and the supplies allotted to the same. The areas of these two projects are very much the same. I am now dealing solely with the rabi and with the perennial canal. The gross area of the Haveli is 695,000 and of the Bikaner is 730,000 acres. The culturable commanded area of the Haveli is 608,000 and of the Bikaner 650,000 acres. The mean supplies allotted to Bikaner in rabi, worked out on the actual averages of the last 15 years, amounts to 1,072 cusecs—the mean daily supplies on the Bikaner canal at head. The mean supply asked for the Haveli is 1,788.

My point is not that the Haveli should be cut down. My point is, that when any amelioration of the Bikaner portion of the Sutlej Valley is found feasible we would ask Mr. Nicholson whether the Punjab would object to any such amelioration being carried out in view of the huge additional benefit which they are now asking for, from one of the tributaries of the Indus.

696. Turning now to the comparison with the proposed conversion of the non-perennial area to perennial area in the Panjnad—I give similar figures. Their culturable commanded area is about 275,000 acres and the mean rabi supply asked for, will work out at about 1,300 cusecs. The mean supply which Bahawalpur has asked for on the Panjnad is about 800 cusecs at canal head in rabi, the area being 50% (subject to verification). The discharge asked for compares very much more than favourably with the actual mean discharge which the Bikaner Canal can receive. I would ask Sir Bernard Darley whether in the event of this supply being granted, he could see his way, if the rabi supplies in Bahawalpur should be found to be in excess of the requirements, to carry out some re-distribution on the Sutlej.

697. **Mr. Nicholson :** I think that Sir Bernard Darley is feeling the effect of clause 4, D. 2 of the Agreement by which restrictions are placed on the possible withdrawals for the canals taking off at the Panjnad. It should be appreciated that this clause is not in any way introduced as a hardship to Bahawalpur but simply to safeguard the interests of the rest of the Punjab as against Sind. Should it be found that all the requirements of the Punjab can be met, and Sind still feels that the further withdrawals for special irrigation supplies or supplies when available, beyond their requirements is possible, I have no doubt that the Punjab would not desire to enforce any restrictions on Bahawalpur provided no indirect difficulties arose.

698. **Sir Bernard Darley,** a few days ago, put in a statement ⁽⁴⁹⁾ showing the areas in Bahawalpur for which supplies are now asked. This statement is very complicated and has been checked by me and verified in various ways from the original Project, up-to-date. I hope to have it sufficiently complete to go over it with him and to find out definitely how all these changes have taken place, particularly in connection with the canals taking-off from the Panjnad.

699. Under the Project, the Abbasia canal was constructed for the irrigation of 270,000 acres of waste land which, I believe, has been found to be un-irrigable, and in place of this, in the Sutlej Enquiry Committee's report ⁽⁵⁰⁾, it was proposed

⁽⁴⁹⁾ Appendix IV (D).

⁽⁵⁰⁾ Report of the Sutlej Valley Project Enquiry Committee, Bahawalpur, 1932.

to cut off an equivalent amount from the non-perennial area beyond the railway line which was considered fit for perennial irrigation. Somehow or other this has resulted in the full supply capacity of the Abbasia canal being raised from 1,032 to 1,660 cusecs. Sir Bernard Darley will appreciate that under the terms of the Agreement we can only consider a canal of 1,032 cusecs capacity just now.

700. It would not be out of place here to refer to the situation in connection with the Haveli project and the Panjnad Weir. See the Note of January 1920, of the Council of Regency, Bahawalpur State, page 5, paragraph 12. In this case it is pleasant to notice that conditions are found to be more favourable than was anticipated by Bahawalpur when the Project was drawn up. In Part II—Note by the Irrigation Officers, Bahawalpur, paragraph 4, section (iii), reference is again made to the bringing in of supplies from the Chenab. On page 27 “The Haveli headworks and canal works come into the first stage of the programme, since these and weir No. IV and the canal works of the same on the Sutlej, should come into operation concurrently”. We see therefore that at that time, the Punjab had the full sympathy of Bahawalpur regarding the necessity of constructing the Haveli Project.
701. On page 28, paragraph 44—“(5) Weir No. IV Panjnad—The advantages of this site are that it shortens Bahawalpur canals and serves to admit of utilization of the seepage waters of the Sutlej and Chenab rivers, while it admits of a remedy being provided for deterioration of the Chenab and Indus series of canals. Further it will serve, when executed, to give Government a free hand with the Haveli project. The adequacy of the water supply has not yet been demonstrated, and careful observations are required on both the Sutlej and Chenab rivers below the Islam, Karampur and Haveli proposed weir sites, respectively on these rivers. The seepage lengths aggregate 240 miles, which at 2 cusecs per mile, promise to yield 480 cusecs”.
702. Again at page 37, section 84 (12 iv) “Bahawalpur is offered a problematical ooze supply of water in lieu of a real and assured one overground”. Now again we see that the pessimism of Bahawalpur representatives has not been justified. It appears from Sir Bernard Darley’s statement that in view of the changes in areas which he has proposed, that the capacity of the non-perennial channel from the Panjnad would be decreased from 9,567 cusecs, according to the Project Agreement, to 6,096 cusecs.
703. The question has been raised of equal treatment as regards the capacity of canals for the Haveli Project and that of Bahawalpur and Bikaner. It appears that four cusecs per thousand acres, perennial, and 6 cusecs per thousand acres, non-perennial, has been maintained in all projects so as to avoid yet another question arising, regarding which there might be unnecessary discussion.
704. Sir Bernard Darley has suggested that the Haveli Project should assure supplies to the Bahawalpur canals taking-off from the Panjnad. It has been shown from the Bahawalpur representation of 1920 that they admitted that the British Government had a free hand with the Haveli Project. It may be noted that in the despatch, No. 15 P. W. from the Government of India to the Secretary of State, of the 17th. March 1921, with which the Sutlej Valley Project was forwarded to the Secretary of State, that in paragraph 9 of the note of the Inspector-General of Irrigation accompanying that despatch, the benefits of the fourth weir on the Panjnad are dealt with. Under the item “secondly” in this paragraph, it will be seen that it is accepted that the construction of the Panjnad weir and canals taking off therefrom, gives a clear road for the construction of the Haveli project.
705. Under section 4. D. 2 of the Sutlej Valley Agreements, Bahawalpur is given “debenture shares” up to a definite amount on the Chenab and the Punjab are ensured debenture shares for the Haveli Project, consequent upon what has been pointed out above and also the fact that they have incurred a share of the cost of the Panjnad headworks amounting to some 76 lakhs of rupees. This clause 4. D. 2 was introduced, not only to guarantee the Haveli Project going through without opposition from Bahawalpur but also to safeguard the interests of the Punjab in connection with the Thal Project.
706. If this Committee can find that the Haveli and the Thal projects can be constructed on the supplies available in the rivers, I think there is little doubt that every consideration would be given to Sir Bernard Darley’s request for special

consideration to the Panjnad Headworks provided that it is found by the Committee that such modification could be granted without adversely affecting the interests of Sind, and possibly Khairpur.

707. Mr. Trench has raised the point that when the maximum discharge of 1,250 cusecs was accepted as being the maximum and not the mean full supply authorized for the perennial channel, I think he must have omitted to consider the fact that the statement before the Committee in Bombay in 1929, which is reproduced as an enclosure to the Punjab BRIEF, shows the capacity of the perennial canal as 2,782, which was rounded off to 2,750. It is hardly conceivable in a perennial canal of 2,782 cusecs head capacity, that the supply at the commencement of the rabi sowing period should be restricted to less than half. This comparison still further tends to indicate that there was confusion in the minds of some people who were present while the Committee was functioning.

708. Mr. Trench has expressed his nervousness at the idea of 2,750 cusecs, the full capacity of the canal, being withdrawn any time during the rabi, I would draw his attention however, to the fact that it is only at the commencement of the rabi season before the rivers have fallen and the end of the rabi season when the rivers are rising that these full supplies would be utilized. During the period when the rivers are lowest, the supplies withdrawn would be only 825 cusecs, which is much less than that was originally granted.

709. It appears therefore that the Punjab withdrawals fit in with the natural flow stage of the river and indicates that the supplies will be utilized to the best advantage. The increase of supply from 1,250 to 1,700 is only 450 cusecs mean, against which the demand during the period of lowest supply has decreased to 825 cusecs, or 425 cusecs less than the discharge already granted to the Punjab.

710. Regarding Mr. Sladen's point of the difficulty of 2,750 affecting Khairpur, he has omitted to consider that there is considerable time lag for supplies passing Haveli to Sukkur and that they have a closure during March. In actual practice the maturing of wheat takes place slightly later than in Sind and whereas they require the final watering of wheat in February, we require it in March. I think there will be little difficulty experienced in connection with these withdrawals during this period of wheat maturing, especially as they admit that they can have a total closure prior to that date. There would be a reduction in supply withdrawn from the river as the individual areas receive their final watering.

711. Regarding Mr. Foy's suggestion, I may say that federation is the catch word of the day, and I feel that all parties here are inspired by the desire to work on that principle with regard to the distribution of waters available, concomitant with accepting responsibilities which should be fulfilled.

712. Mr. Foy : May I make an observation which should help us to find a solution. The chief difficulty with regard to rabi supplies as between Haveli, Panjnad and Sind seems to be the March supplies. There are excess supplies in the Chenab above what they are asking for, during January and February and there is generally an excess supply at Sukkur during those months. The point is that both at Haveli, when it is constructed, and at Panjnad above the weirs, there is an enormous storage capacity which is quite capable of storing the excess supplies in the Chenab during January and February and letting down an additional 3,000 cusecs of that stored water for practically the whole of March. This is borne out by experience of the barrages on the Sutlej where, during the recent freshets in February, enough water was stored at Islam to give 1,350 cusecs at Islam for 20 days.

713. Sir Bernard Darley : Mr. Nicholson stated that the area within the irrigation limits of the Sutlej Valley Project was fixed for the perennial canal from Panjnad at 270,000 acres, and that the Sutlej Valley Committee recommended that an equivalent area should be cut off at the tail of the Panjnad non-perennial canal and changed into perennial. This is not quite correct. What the Committee's actual recommendation in this matter was this :—

“ The clauses in the Agreement of 1920 which restrict the supplies to be drawn off by the Abbasia and Panjnad canals in any season to those drawn off by British canals from the Sutlej alone, should be deleted with the concurrence of the Government of Bombay and a maximum fixed for the Abbasia canal, so that it may not draw off more than 930 cusecs as the average supply during the rabi season.”

714. The Sutlej Valley Committee fixed the line of the new feeder so that it would cross the country at a point bringing within the command of the feeder the maximum area of State waste land. This was possible by aligning the feeder so that it exactly hit off the heads of channels which existed at the tail of the Panjnad canal and irrigated the area south of the railway. This area was greater than the Project area which was to be irrigated perennially, viz. 270,000 acres. For that reason, they recommended that clause 4. D. 2 of the Agreement should be deleted and a greater average supply allowed than was allowed in the Project. It was acting on their recommendation that the Government of India then addressed the Governments of Bombay and the Punjab, and this resulted in the appointment of this Committee to consider the whole question.
715. Mr. Nicholson mentioned it was proposed to give special treatment to the canals taking off from Panjnad. Bahawalpur is not asking for any special treatment. It only asks for equal treatment with Haveli; that is, if the average supply factor is fixed at 6.0 cusecs per thousand acres for non-perennial canals at Haveli, then the same factor should be used in the case of Bahawalpur non-perennial canal which on the figures put in by Bahawalpur would receive 6,096 cusecs on this basis.
716. The third thing Mr. Nicholson mentioned was that Haveli should have special treatment in view of the fact that the Punjab Government had paid something like Rs. 76 lakhs towards the construction of the Panjnad Weir. That money was given without any connection with the Haveli project, but for two other reasons; one was that the British Government wished to reserve to themselves the right to take off a canal from the Panjnad into Sind, if necessary later. The second reason was that Bahawalpur for many years had been claiming that their inundation canals had been very adversely affected by the withdrawals by Government canals from the Punjab rivers above, and that but for these withdrawals, it would have been unnecessary to build the Panjnad weir and therefore the Punjab Government should pay a portion of the cost.
717. In letter No. 01209-W. I., dated the 8th. September 1920 from the Punjab Government to the Government of India this is clearly stated.
- “Provision is made in the design of the weir on the Panjnad for taking a canal from it to irrigate the $1\frac{3}{4}$ million acres of Sind on the left bank of the river Indus above the command of the Sukkur Barrage Project. This will make it unnecessary for a weir to be constructed by Sind below the junction of the Indus and Panjnad as has been contemplated.
- This Government has undertaken to relieve Bahawalpur State of a proportional share of the Panjnad Weir amounting to Rs. 40 lakhs on account of this possible withdrawal and to meet the request of the State that they should be relieved of some of the cost of this Weir in consideration of the fact that its necessity might partly be attributed to the withdrawals in the past, of the Punjab canals upstream of it.
- This sum of Rs. 40 lakhs has not been included in the capital cost for the purpose of estimate of revenue returns, as if the proposed canal for Sind be constructed, the whole should be borne by Sind, or in case the proposal did not mature, the cost would be distributed *pro rata* over the capital accounts of the canals on the Punjab rivers existing at the time.”
718. It is therefore obvious that this payment has no connection at all with the Haveli project, but is in view of the withdrawal by the Punjab canals in the past.
719. As regards Mr. Foy's suggestion, the Bahawalpur Durbar would be prepared to consider the point, provided of course that a suitable *quid pro quo* is given. I would like to deal with this point later on.
720. Mr. Nicholson: With regard to what Sir Bernard Darley has said I only refer to the quotations which I have brought on the record showing that Bahawalpur admitted that the construction of Panjnad Weir gave the Punjab a free hand with regard to Haveli, and furthermore to the Despatch from the Government of India to the Secretary of State in which it is stated that the construction of the Panjnad Weir removed all further possible objections from Bahawalpur and gave Punjab a free hand with Haveli.

721. I do not think that anything clearer and more definite could be required on this point. The mere fact that advantage was taken to look after the interests of Sind in the terms of the agreement should not in any way debar the Punjab from the main benefit which accrued to it. It was undoubtedly to cover the interests of Sind, and if they desire to take advantage of it, they should pay for the benefit, but the Punjab held themselves responsible for the money, whether Sind came in or not, in order to insure themselves against any eventuality.
722. *The Chairman adjourned the meeting for luncheon at 1-15 p.m.*
723. *The Committee re-assembled after lunch at 2-30 p.m.*
724. **Chairman :** Before proceeding to the next ISSUE I would ask Mr. Nicholson to explain briefly his proposal regarding diverting water from the Ravi into the Beas. That is directly connected with the Haveli Project.
725. **Mr. Nicholson :** This point was referred to in my BRIEF. I did not develop it this morning because I thought it was rather obvious. With all the local knowledge one has oneself, one fails sometime to realize that others have not got that intimate knowledge of the case to appreciate the point at issue.
726. If you look at the map of Punjab Irrigation you see Madhopur situated on the Ravi, and that the Beas runs within 15 miles of it.
727. **Mr. Nicholson** *proceeded to explain the scheme for diverting water from the Ravi into the Beas and tabled hydrographs* ⁽⁵¹⁾ *showing detailed discharges for several years of the Ravi river below Madhopur.*
728. **Mr. Nicholson (contd.) :** I have previously shown the hydrographs of supplies passing below Sidhnai headworks based on ten day periods. A comparison of the Madhopur and Sidhnai hydrographs for 1934 and 1935 in July will show the enormous loss that there is all over, and a similar comparison for other years gives a similar result.
729. The Lower Bari Doab canal is precluded from utilizing the supply passing in the Ravi until after the Sidhnai canal at its head gets full supply, which is not a common occurrence except in the period shown when there is surplus available downstream thereof.
730. In the 1932 Haveli Project at page 17 Statement VIII, an abstract is given showing supplies which could have been utilized in the Sutlej Valley Project by switching over surplus supplies made available in the Ravi at Madhopur. Had the Haveli project been completed, assuming the capacity of the feeder as 5,000 cusecs, it is seen that on an average from April 16th. to April 30th. 2,300 cusecs mean discharge would have become available. From May 1st. to May 31st. a mean supply of 2,500 cusecs would have been available. The figures have not been worked out in detail for June, but still higher average would have been available for transfer from the Ravi to the Sutlej Valley Project. There is another indirect benefit from the construction of the Haveli Project which may not be generally appreciated. Not only does the Punjab benefit but the other partners in the Sutlej Valley Project can do so too.
731. At Madhopur there is the old Sikh canal which was abandoned when the main line of the Upper Doab was constructed. The capacity of that canal has subsequently been increased and the old Sikh canal is now utilized as a feeder. The main line of the Upper Doab canal is in heavy digging and to increase the capacity of this canal, to carry the supply to the nearest point where it could be dropped into the Beas would not offer any great difficulties. No estimate has been framed but purely on an engineering inspection of it, it is known that it is not a formidable undertaking.
732. **Mr. Trench :** Assuming that the Haveli Project is constructed and the switching across of the 2,300 cusecs takes place, will it then definitely rank as an additional withdrawal ?
733. **Mr. Nicholson :** No, it is lost over 435 miles of river. Similarly, there is a possibility of switching water from the Jhelum, which is the earliest rising river in the Punjab, through to the Sutlej by means of a feeder channel from Akhnur on the Chenab through to the Beas, crossing the Ravi downstream of Madhopur. If this proposal is put into effect, Madhopur headworks on the main line would become inoperative and would be available for the development of hydro-electric

power from 120' of fall which exists in the head reach of the main line. The switching of the water from the Jhelum would not be direct. The Jhelum water would be passed into the Chenab above the headworks of the Lower Chenab Canal and an equivalent amount of water would be withdrawn from the Chenab at Akhnur.

734. Mr. Foy : Far be it from me to look a gift horse in the mouth. There is no doubt that those supplies would be of great value to the Sutlej Valley Project. Unfortunately, the Ravi and the Beas catchments are very similarly situated and close together so that while in medium years that supply would be intensively valuable, in the very poor years there would be no real appreciable supply as is shown from the figures given in statement 7 of the Haveli Project Report. So while I welcome this proposal it is not a substitute for a storage scheme or for protection of the perennial areas in really bad years by some process of giving them priority.

735. Mr. Nicholson : I never suggested that it is an absolute cure but half a loaf is better than no bread.

736. Sir Bernard Darley : How much is the feeder likely to cost? Could you just give us a rough idea of the cost?

737. Mr. Nicholson : Just a few lakhs, perhaps something of the order of 20 lakhs.

738. It also makes storage on the Ravi and all its tributaries transferable to the Sutlej, so that the Sutlej Valley Project would then be able to benefit from storage on the main Ravi river as well as from the drainages coming in from Kashmir between the Ravi and the Chenab, which have a considerable potentiality for storage development.

739. In the rabi sowing period, the whole supplies are utilized in the Upper Bari Doab Canal. This river falls early and rises early.

740. Mr. Nicholson in answer to the Chairman : In February and March, the quantities are not of such great moment.

741. This matter has not been worked out in full detail but it is appreciated that there is sufficient ground for considering that it would be one step towards alleviating the early kharif shortage.

742. Chairman : This proposal would be of no benefit at any time in the rabi but only in early kharif in certain years.

743. *Question of withdrawals under No. 8 of the ISSUES was then taken up for consideration and Mr. Nicholson was asked to put forward his observations.*

744. Mr. Nicholson : Without repeating what has already been written in the BRIEF, it may be pointed out that the Punjab now proposes to abandon the idea of the large Thal Canal or the canal to irrigate the whole of the Sind-Sagar Doab which consists of a gross area of more than 4 million acres. We propose to restrict the irrigation to a gross area, as shown on the statement attached, ⁽⁵²⁾ of 1,500,000 acres which has been determined as being the best land in the Thal and suitable for efficient economic irrigation. It was to guard the interests of the Haveli Project and the Thal Project that clause 4. D. 2 was inserted in the Sutlej Valley Agreement. Should it be possible to get agreements that these projects could be constructed and supplies allotted to them, then it might be possible to consider the modification of clause 4. D. 2. It was in the interests of this project that the Punjab carried the share of the Panjnad headworks referred to in this morning's proceedings.

745. I have here a hydrograph ⁽⁵³⁾ showing the supplies which are available in the Indus below Sukkur for the years 1928 to 1935. The Sukkur Barrage has only been functioning for the last three years and only partially, so that the total supplies passing below Sukkur are indicated by the blue shaded area. It is seen that the supplies which Sind could have withdrawn are in excess, in most cases, of what they have actually withdrawn. In some cases, however, Sind has withdrawn more than they are entitled to. This has been specifically indicated on the hydrographs.

746. At the bottom portion of this hydrograph shown in green, is the supply which would have been withdrawn for the Haveli and Thal projects as put forward in the

(52) Appendix IV (B).

(53) On record in Central Board of Irrigation office. (P. 92)

blue print ⁽⁵⁴⁾ and the statement of mean monthly discharges shown on a separate statement ⁽⁵⁵⁾ compiled as requested by the Chairman. It will be seen from the inspection of these hydrographs that in no case would there have been any restriction of the supplies required for Sukkur at the Barrage except for the 10 day periods in April 1934 but as we know, Sind have closures thereabouts at that period and to adjust this small item would not be an insuperable obstacle.

747. Mr. Trench : This Thal project has been on the tapis for some time in various ways and in different magnitudes. When it was first known to the Government of Bombay that a Thal Project was under consideration, they wrote a letter to the Government of India No. 2969-I of the 3rd./10th. February, 1925 ⁽⁵⁶⁾. *The letter was read out by Mr. Trench.* I wish to mention that particularly because it is quite evident that Government of Bombay had in mind from very early stages, the effect of the possible withdrawals of any Thal scheme on the inundation areas in Sind. That bears on the matter to which we referred previously as to whether it is only the canals in Upper Sind that were in question or not. Subsequent to that letter the Government of India issued orders in letter No. 1-61 dated the 18th. February 1926 from the Hon'ble Mr. A. H. Ley, Secretary to the Government of India, Industries and Labour Department, to the Secretary to the Government of the Punjab.

748. I will read the 2nd paragraph of this letter—

“The Government of India have given their most careful attention to the matter and as a result, have arrived at the following conclusions.

(i) That until such time as the Sukkur Barrage scheme comes into operation, and further experience of perennial irrigation in Sind is available, the question of the volume of water required for that scheme cannot be reopened.

(ii) That faced as they are, with the unknown effect of the withdrawals which will be necessary for the supply of the Sutlej Valley Canals in the Punjab, the Government of Bombay have the right to object to further withdrawals from the Indus or its tributaries unless and until definite proof can be given that the supplies necessary for the Sukkur Barrage project will not be endangered thereby.

(iii) That . . . such proof must be based upon the results of the more accurate gaugings of the river Indus and its tributaries.”

749. Now that was the position before the Indus Discharge Committee started its work, and as Mr. Nicholson and others have said, the Indus Discharge Committee in 1929 decided that a 10 year period was necessary to prove from further records of more gaugings, whether the supplies were available or not. This postponed further consideration for 10 years. The 10 years have not yet elapsed and as I have repeatedly made clear, the effect of the Sutlej Valley Project canals on the Sukkur Barrage Project has not been clearly demonstrated because of the short period and of the varying climatic conditions which have occurred during that period.

750. But what I really quoted this correspondence for was to impress as far as I can on the Committee, that it is not only the question of the Sukkur Barrage but it was a question in the mind of the Bombay Government, in regard to the effect of these proposed withdrawals on the inundation canals of Sind.

751. I feel that, in regard to the Sutlej ; in regard to the tributary rivers of the Indus and in regard to the Indus itself, our attitude must of necessity be somewhat different. I feel that in regard to the remaining waters of the Sutlej or Panjnad, we are to a certain extent, fighting with our backs to the wall. I am not prepared to admit that what little water remains in the Sutlej and in the Panjnad now, is *not* of any value to the Barrage and inundation canals in Sind.

752. I do feel that in regard to the withdrawal from the Indus, we have to look definitely more askance at any proposals to withdraw water from it, and the present proposal is to withdraw 6,000 cusecs in the kharif season till the latter

(54) Plate IV.

(55) Appendix XIX.

(56) Appendix XIII.

part of October and 2,000 in December and January. I consider that the withdrawal of a monthly mean of 2,000 cusecs from the Indus would gravely affect our prospects in the Barrage canals in certain years and I also consider that the 6,000 cusecs which it is proposed to withdraw from April to October including September would be extremely prejudicial to the position of the inundation canals.

753. I have, when dealing with questions of water for perennial and non-perennial canals, shewn that the abstraction of 10,000 cusecs from the Indus at any time would lead to postponing at certain significant dates, of the inundation by as much as 6 days at 12' level at the Kotri gauge and about 5 days at 16' level. You may take it that the graphs are practically straight lines for those short distances and 6,000 cusecs would be about 6/10ths or 4 days instead of 6 days. That is a very serious matter from the point of view of the inundation canals and I do not see how the Government of Bombay or their irrigation officers would be prepared to agree to any proposal which led to such a result.

754. **Sir Bernard Darley :** Might I suggest a possible solution based on what Mr. Trench has said, that he would not look with so much askance at the withdrawals of the Chenab and the Panjnad as he would at the withdrawals from the Indus, I would say that the Committee should recommend that the Thal Project should be postponed until 1939 as originally intended and that reasonable supplies be given to enable the Haveli and the Panjnad to work efficiently.

755. **Mr. Trench :** We do not yet know the effect of the Haveli project. I feel that is a question to which I cannot record a definite reply. I cannot commit my Government on the lines of the solution suggested by Sir Bernard.

756. **Chairman :** You have no authority to express an opinion ?

757. **Mr. Trench :** No. I have not put it to my Government. As a member of the Committee, I can express an opinion about it but I cannot commit my Government. I can give my personal views.

758. **Chairman :** Would you mind doing that ?

759. **Mr. Trench :** I would go so far as to say that this is the lesser of the two evils.

760. **Chairman :** Beyond that you are not prepared to go ?

761. **Mr. Trench :** Not without further careful consideration.

762. **Mr. Foy :** Perhaps it would assist Mr. Trench if the usual capacity factors were applied to both the Thal, the Haveli and the Panjnad withdrawals during April and May. Experience has shewn that in the Punjab, all that the canals require is about 0.6 in April and 0.8 in May. The Thal withdrawal is 6,000 cusecs and the withdrawals of the Haveli and the Panjnad, 15,000 cusecs making a total of 21,000. Following the normal practice in the Punjab 0.4 of this amount will not be required for these canals. That would be 8,400 that is 0.4 of 21,000. This would go some way to reassure Sind. 8,000 in April and 4,000 in May, less than the total authorized discharges of these three.

763. **Mr. Nicholson :** *referring to the hydrographs :* The area coloured green showing the discharges required for the Haveli and Thal, include the discharge already withdrawn by the existing inundation canals.

764. **Mr. Trench :** Could you give us any rough idea of the inundation canal discharges ?

765. **Mr. Nicholson :** I can give you exact facts. 6,500 cusecs represent the actual withdrawals for the inundation canals.

766. **Mr. Trench :** I would just like to mention that in 1934 we were short of our demands by 15% of the authorized withdrawals for 17 days at Sukkur.

767. **Mr. Oram :** We have no great apprehensions that this project will affect the Paharpur canal scheme. It may possibly affect the level of the Indus from which we take off. It is not proposed at present to build a weir across the Indus : that is a very big undertaking for a very small canal. But it will be a question which we in the North-West Frontier Province and the Punjab should consider if the opening of the proposed Thal canal does affect the possibility of the North-West Frontier Province withdrawing the small supplies as easily as they did previously.

768. The present work is itself a large insurance against any such effect. Therefore it reduces the effect which the Thal would have had on the original Paharpur Canal. The North-West Frontier Province does not forego a claim for assistance from the Punjab to move the head of the Paharpur canal still further upstream in case it should be necessary.

769. Mr. Trench : I should like to make an addendum in regard to the deficiency of water supply in April 1934. The deficiency is important in that month particularly, because it has occurred in one out of the first 3 years of the operation of the Barrage and secondly because it has occurred in a month in which both the Thal and Haveli projects mean discharges for that month, will suddenly rise from a comparatively small figure to a very much higher one.

770. Mr. Nicholson : With regard to Mr. Oram's remarks about the Punjab being in any way responsible to maintain the level of the water surface at the head of the Paharpur Canal as reconstructed, I refer to the diagrams contained in the report of the Superintending Engineers on the effect of the Bhakra Project on the inundation canals in Sind—No. P-6 $\frac{1.2}{17}$ from which it will be seen that there is a degradation going on in the river at Bakkar which has moved upstream. Even if the Thal Project is not constructed it is very possible that they may find that the levels of the river have degraded to an extent that they have not anticipated.

771. In view of this fact I would disclaim all responsibility for any effect the Thal Project may have on the welfare of the Paharpur Canal as apparently the river itself, is far more likely to upset their calculations than the construction of headworks for the Thal Project. Mr. Oram is probably fully aware of the damage which occurred at Dehra Ismail Khan in 1920-21 which had led to heavy training works being constructed. The causes of this, as some of the hydrographs will show, are the conditions of which the local officers were unaware when they were fighting with the river.

772. Adverting to the question of the effect of the withdrawals for the Haveli and the Thal Projects on supplies at Sukkur, it is fully realized by me and I think it has been fully realized by every one connected with the problem in the past that there must be years of shortage at infrequent intervals, which will necessitate an adjustment of the utilization of supplies for any new canal project above Sukkur on the Indus.

In most years during April, no difficulty would arise, but in years in which shortage occurred, undoubtedly the Punjab would be only too glad to reduce its demands on the river at Kalabagh so as to ensure an equitable distribution between the Punjab and Sind. I think it is unfortunate that in Sind, they have a nervous apprehension that once a headworks is built on a river, if the control is not in their hands, that the water will pass away unseen, unrecorded and beyond recall. If such a spirit did exist in the past I trust that it is now defunct ; at any rate, I should think the inspection of the records of the waters of the Indus and distributaries now maintained, would make any attempt at giving a false account physically impossible.

773. The mean diagram previously considered in connection with the supplies at Sukkur shows the conditions from a bird's eye view. Coming down to closer details, further detailed hydrographs are put forward (57) showing the permissible withdrawals for each canal in the canal system taking off at Sukkur and the total withdrawals. From these it will be noticed that the Eastern Nara Canal has already in October, exceeded its permissible supply with great regularity each year to an extent of approximately 60% to 70% in excess of that authorized in that month and by 25% to 30% in November : in January and February lesser excesses have been withdrawn over those permissible.

774. In the Khairpur State canals we notice that excess supplies have not only been withdrawn during January, February and March which are not permissible under the orders of the Secretary of State interpreted literally, but also excesses have been withdrawn in September and October. Mr. Trench explains that such conditions are not permissible but only allowed as an act of grace which does not amount to a claim. In the case of the right bank canals of the Sukkur Barrage also, it shows that

in the month of September in each year the supply has been in excess of that permissible. When we come to the total withdrawals, we still notice they demonstrate that in the month of October in each year there has been an excess of withdrawals over the authorized. It is important that this point should be borne in mind when considering the supplies available below Sukkur. To the supplies available below Sukkur in every case, should be added the excesses withdrawn in the canals above permissible. Should this go on unquestioned for a long period of years, it might be subsequently stated that a prescriptive right had accrued in spite of any statement to the contrary.

775. **Mr. Trench :** I should like to remark on the October excess. Though undoubtedly there has been an excessive withdrawal in October—not excessive, but withdrawal in addition to the allotted supply—it has been withdrawn under the authority of the Government of India's orders which state that there is no objection to such withdrawals provided the water is there ⁽⁵⁸⁾. “With reference to the correspondence resting with your letter No. 8255-I. W., dated the 3rd June 1929, I am directed to say that the Government of India have no objection to certain of the canals in the Sukkur Barrage project being designed to draw off a larger volume of water than that allotted to them in the project estimate, on the conditions proposed by the Government of Bombay, viz., that no prescriptive right to the additional quantity of water is claimed by the local Government and that the additional water will be utilized only when available, instead of letting it run waste”.
776. **Chairman :** Was a copy sent to the Punjab Government ?
777. **Mr. Trench :** Of our resolution ?
778. **Chairman :** No, the Government of India's letter.
779. **Mr. Trench :** That I cannot tell you.
780. **Mr. Nicholson :** It was never seen by us. Our first knowledge of its existence came to light when we received copy of a letter No. 6509/23 I. W., dated Bombay Castle, the 26th. June 1933 from the Secretary to the Government of Bombay, Public Works Department to the Deputy Secretary to the Government of India in the Foreign and Political Department. A copy was received from the Deputy Secretary to the Government of India in the Foreign and Political Department with his letter No. F.-211/R.-33 to the Secretary, Government of Bombay, Public Works Department and the Chief Secretary of the Government of the Punjab, dated 9th. November 1933. The reference to the letter in question and the enclosure in the last quoted letter were not noticed until quite recently when it was found that a copy of that letter had never been received by the Punjab Government.
781. A demi-official reference was made asking that a copy might be supplied as it appeared to be of moment, because in the first reference quoted above—the letter from the Secretary to the Government of Bombay, Public Works Department—this letter was quoted as the authority for an increase of the authorized withdrawals at Sukkur, in excess of those approved by the Secretary of State.
782. When we came to know that these figures were sanctioned in a Government of India letter, we searched hard for it and finally got a copy from the Government of India, and then we found the situation was strange.
783. **Chairman :** What is the point we are trying to make ?
784. **Mr. Nicholson :** Mr. Trench pointed out that they had been authorized to draw more water than sanctioned by the Secretary of State and I pointed out that this extra withdrawal was contrary to the orders of the Secretary of State.
785. **Chairman :** That has no direct bearing on the point at issue.
786. **Mr. Nicholson :** Excepting in so far as it will remove conflict of interest regarding what is right and what is wrong.
787. **Chairman :** Indirectly.
788. **Mr. Trench :** I do not think we need labour that point.
789. **Sir Bernard Darley :** The only thing I have to say is that I do not think we are in a position really to consider what supplies are required for the Thal project

(58) Letter from the Government of India No. I. R.-6, dated 29th. June 1929 printed in the preamble of the Bombay Government's Resolution No. 8255 of the 25th. September 1929. [See Appendix X(B)]

at present. I think that a soil survey should be done first on the same principle as was done for the Haveli project before we attempt to allocate any supplies to that area.

790. Mr. Foy : I have not anything further to add.

791. Mr. Oram : Nor I.

792. Mr. Nicholson : With regard to Sir Bernard Darley's remark. The area we are proposing to take is less than one-third of the gross area, and the areas were determined by a Superintending Engineer of experience. He was of opinion that the major project was impracticable and he put down in this project those areas which he knew from personal knowledge to be suitable. The tract has been surveyed on a scale of 6" to a mile, rectangulated, levelled, and a detailed record of every rectangle with regard to soil has been recorded already. As we have cut down the original proposal to one-third, I think Sir Bernard Darley can be assured as to the suitability of the area now proposed for irrigation.

793. Chairman : Did Dr. McKenzie-Taylor do the survey ?

794. Mr. Nicholson : Dr. McKenzie-Taylor has not been over this area. This area is high above the Jhelum and has a good subsoil outlet so that water-logging will not occur.

795. Chairman : Gentlemen I suggest we go back to No. 5 of the ISSUES. Mr. Gunn has very kindly prepared certain hydrographs⁽⁵⁹⁾ showing the mean and minimum available supplies at certain points, Ferozepur, Trimmu, Panjnad and Sukkur, and with Mr. Nicholson's permission I would ask Mr. Gunn to explain to us how these hydrographs have been prepared.

796. Mr. Gunn, *Executive Engineer, in charge of the Discharge Division, Punjab, tabled the hydrographs, which had been prepared at the request of the Independent Members. These are reproduced as Plate III and App. XII-(A) & (B). He then explained to the Committee how they had been prepared and the nature of the information displayed.*

797. Chairman : May we accept these hydrographs for the purpose of ascertaining the available supplies which can be distributed to the different parties, now that they have been explained by Mr. Gunn ?

This suggestion was unanimously accepted.

798. Chairman : I propose now to pass on to No. 9 of the ISSUES before us. I suggest that Mr. Nicholson should explain to us what system is adopted in the Punjab on the Sutlej Valley Project.

799. Mr. Nicholson : So far as the upper Punjab canals at present existing are concerned, there is no question of passing any supplies down to any third party. The only case in which this question arises is the Sutlej Valley Project and the Superintending Engineer of the Ferozepur Canal Circle is the controlling officer. He works according to a pre-arranged programme drawn up by the superintending engineers of the various canal circles concerned.

800. For the Northern canals a day-to-day account is kept of the distribution of the water available, and it is balanced at certain points during the rabi, when all the canals have to utilize water pooled from three rivers. The Superintending Engineer, Upper Jhelum Canal, carries out the regulation through the Executive Engineer, Jhelum. Similarly there is a programme of distribution for the whole rabi crop. At the end of every ten-day period a detailed account of the distribution of water in that period and the total distribution to-date is sent to all interested parties. The crop period is divided into three parts ; sowing period, kor watering period and maturing period. If before the end of the sowing period the distribution according to the programme shows that there will not be an equal balancing at the end of the sowing period, adjustments are made.

801. As regards the distribution of the waters of the Indus between Sukkur and the Thal Canal shortages are likely to be so infrequent that it appears unnecessary to have a special distribution officer, as, with the intimation of the daily discharges in the river at Kalabagh to Sukkur and conversely with the intimation of discharges available at Sukkur to Kalabagh, it can be foreseen when the river is

(59) Plate III & Appendix XII, (A) & (B).

falling, when the supplies available are likely to be below demand whereupon the sharing on the agreed basis will come into effect.

- 802.** As regards Haveli and Panjnad, river supplies will have to be shared, and the question of utilizing any supplies in excess will be a subject for consideration in conjunction with Kalabagh. I venture to suggest that a possible solution to difficulties might be obtained by severing the Panjnad river from the main Indus and by holding that there is direct connection between any short supply at Sukkur and the Thal project and not the Chenab and the Sutlej.
- 803.** The Chenab being so heavily loaded there is very little water of any value which passes down which could be utilized at Sukkur. You have seen from the hydro-graphs that the Sutlej and the Ravi contribute no water whatsoever to the Panjnad except between the periods late in June and in September, and during this period there is no question of shortage of water in the Indus. In the spring when the Chenab rises it rises at a rapid rate, and the capacities of canals withdrawing from Haveli and Panjnad are small compared to the rapid rise of the river. So, if the Panjnad could be separated from the main Indus, it would materially simplify all future dealings in connection with supplies for irrigation from the existing tributaries.
- 804.** **Mr. Trench :** In regard to the question whether there should be a controlling officer I presume that as it stands it would be generally understood to mean a day-to-day controller.
- 805.** **Chairman :** A Superintending Engineer ?
- 806.** **Mr. Trench :** There should be a referee of some sort. If there were a Consulting Engineer to the Government of India, he would be the obvious man to be referred to in case difficulties arise.
- 807.** **Chairman :** To speed up a decision on any dispute between two parties ?
- 808.** **Mr. Trench :** I think it is important that there should be some central authority to whom disputes or disagreements or differences of opinion can be referred.
- 809.** In regard to the separation of the Punjab tributaries from the Indus, which Mr. Nicholson has mentioned, as a method of relieving the situation, I do not think I can let it pass without recording that I do not consider that the supplies in the Sutlej are of such small proportions that they are not of essential use to the Indus canals, and especially the inundation canals during the months of May and early June and September. The discharge in September last year which passed down the Panjnad was 46,757.
- 810.** **Mr. Nicholson :** The controlling officer could have no power over that because that is the balance. You have no power of restricting withdrawals beyond the capacity of the canals at Panjnad now.
- 811.** **Mr. Trench :** There are two points really : one is whether the discharges below the Panjnad are of use to Sind ; and the other is, whether a controlling officer would in any way alter them. On the first point I would like to record that I am not in complete agreement with Mr. Nicholson. I do think that the other point is a very important one.
- 812.** **Mr. Nicholson :** I agree to it if it is practicable to have a whole time officer of sufficient standing, but if he is in the Punjab, Sind may say he is biassed.
- 813.** **Mr. Trench :** I am in favour of a central authority.
- 814.** **Chairman :** Whole time authority ?
- 815.** **Mr. Nicholson :** Mr. Trench wants either an Inspector-General or Consulting Engineer, but with political interests at play, he will hesitate.
- 816.** **Sir Bernard Darley :** I do not know exactly what the proposal is.
- 817.** **Chairman :** Suppose for instance, Bikaner complains he is getting less than his rights : he will have the right to appeal to the Punjab Government or the Government of India.
- 818.** **Sir Bernard Darley :** That would cause delay. There should be some one on the spot to decide questions as they arise. In regard to the distribution on the Gharra reach, I find the present arrangements entirely satisfactory. We have

meetings once every three months between the parties concerned and we draw up a programme for the following three months based on the average supply at the time and a forecast of what is likely to be available in the coming period.

819. **Chairman :** An occasion may arise during these three months which may necessitate an alteration of the programme ?
820. **Sir Bernard Darley :** It does sometimes arise, but we stick to the programme like the Laws of the Medes and Persians. One or the other partner may be hit.
821. **Mr. Nicholson :** You want one with an intimate knowledge of the conditions which are so complicated, and one who can appreciate repercussions.
822. **Sir Bernard Darley :** I am in favour of starting once more, the post of Consulting Engineer to the Government of India, and he should be the referee.
823. **Mr. Foy :** The controlling officer should be the regulating officer for a unit or group of units, because he alone gets the day-to-day information quickly enough to take action. I do not think you can improve on that. On the Sutlej the ultimate control lies with the Punjab Chief Engineer.
824. While I agree that in the past there has been no serious friction, it is quite conceivable that in the future such cases might arise. I certainly think there should be a referee with the Government of India. He will have to have very considerable authority or his decision will not carry weight. A further advantage of reviving the appointment of Consulting Engineer to the Government of India or having some such central authority would be to keep and digest records necessary for the solution of any impending problems. In this meeting we should have had great difficulty but for the ample data put forward by the Punjab. A central authority would be an ideal one for compiling all such data, and that would be enough to give him work for 12 months.
825. **Mr. Sladen :** In my opinion an officer with the Government of India with executive power to see that agreements arrived at between the parties concerned in the river Indus, are carried out, would be very useful. I do not think it would be advisable to have a man who will go beyond the agreement in any way as an independent water control officer. If there is an agreement to share, and one of the parties to it thinks that they are not getting a proper share, then they can appeal to this officer who will see that the agreement is implemented.
826. **Mr. Oram :** I do not anticipate anything that is likely to require a controlling officer. It would be very difficult to find or place a man who will be really effective. The Consulting Engineer to the Government of India could only deal, after some delay and enquiry, with any differences of opinion. He could scarcely act immediately and put right matters of regulation within hours.
827. **Chairman :** Would you be in favour of a controlling officer specially appointed for this work ?
828. **Mr. Oram :** It is difficult to see how he will have any standing between Governments.
829. **Mr. Nicholson :** It would be a terribly expensive post.
830. **Mr. Oram :** A man in the position of Consulting Engineer to the Government of India would be useful in so far as he could handle differences, and report on difficulties and more or less organize an enquiry, and conduct it, and so on, into such matters.
831. **Mr. Nicholson :** There is no organization of any magnitude in the world without a Consulting Engineer.
Sir Bernard Darley also pointed out the necessity for a Consulting Engineer.
832. **Chairman :** Would you abolish the Central Board of Irrigation ?
833. *The opinion expressed was unanimously against any such step.*
834. **Chairman :** If the post of Consulting Engineer to the Government of India was revived and the implementing of agreements placed in his hands, he would turn to the Board for committees of enquiry on disputes. He might well be *ex-officio* President to the Board. There would doubtless be other work for him of a similar nature in connection with other river basins.

835. *There was general discussion, not recorded on this side issue, leaving the Chairman to conclude that the proposal met with general acceptance.*
836. **The Chairman** adjourned the meeting till 9-00 a.m. on Wednesday the 6th March, 1935.
837. *The Committee re-assembled at 9-00 a.m. on Wednesday the 6th. March 1935.*
838. **Chairman :** Gentlemen, I am sorry to say that Mr. Sladen is indisposed this morning. If you have no objection Mr. Colabawala can represent him this morning. This is much better than postponing the meeting.
839. *The Committee agreed to Khan Bahadur Colabawala representing the Khairpur State in place of Mr. Sladen.*
840. **Chairman :** I suggest we take up the proceedings of 3rd. March 1935 for correction and confirmation.
841. *The report of the proceedings of the meeting held on 3rd. March 1935 was confirmed.*
842. **Chairman :** I suggest we take up the proceedings of the 4th. March, similarly, to keep the record up to date.
843. *The report of the proceedings of the meeting held on 4th. March 1935 was confirmed.*
844. **Mr. Trench :** Yesterday I said that I reserved the right to criticize the figures of Mr. Sladen. I would like to put in my criticism now. Mr. Sladen stated that the culturable commanded area was 3,068,710 acres of dry kharif ; the annual area of cultivation was apparently intended. The maximum discharge was 45,926 cusecs therefore the dry kharif " duty " is 67. These figures are obtained indirectly from the 1920 Sukkur Barrage Project Volume V, p. x, but include the Khairpur State kharif which was allowed a lower duty of 50 and have been obtained by doubling the rice cultivation to turn it into dry crop.
845. In Volume V, pages 8 to 11, however, the figures are also given separately for dry kharif by canal systems and we get :—

	Area, 1,000 acres.	Discharge, cusecs.
North Western Canal	215	2,870
Dadu	111	1,612
Rohri	677	9,650
Eastern Nara	375	4,801
Total	1,378	18,933
This gives a duty of :—		$\frac{1,378,000}{18,933} = 73$

846. **K. B. Colabawala :** Mr. Sladen's point of view was that the Khairpur State canals were designed for kharif, full supply factor of 50, which would irrigate 201,000 acres. He desired that this point should be mentioned to the Committee.
847. In the 1920 Project, it is stated that the feeders are designed with a full supply factor, (then called " duty ") of 50, which would irrigate during kharif 201,000 acres. Bombay engineers had agreed to this duty of 50.
848. **Chairman :** Gentlemen ! in the Punjab BRIEF, Mr. Nicholson has mentioned the Woolar scheme and other storage schemes and he would like to make a few remarks relating to them.
849. **Mr. Nicholson :** The Woolar Lake is in Kashmir territory and it might be said that, as such, it was outside the jurisdiction of this Committee. But in order to avoid any possible misunderstanding later on (that the Punjab had arranged to do something with an Indian State which might be held to be to the detriment of parties lower down the river), I propose to explain it now, so that it may come on the record.
850. This project is quite a small one and has come forward, due to the fact that the Kashmir Durbar dredged the out-fall of the Woolar Lake which resulted in the river falling more rapidly in the autumn than it did previously. The effect has been

adverse to the Punjab and it is proposed to put in a barrage in the outlet of the lake and hold up supply when the river is in flood. The storage will be released when the supply in the river is below the indents of the canals taking off the Jhelum river. The total amount is about 300,000 feet acres.

851. As regards other storage schemes, the question of Bhakra on the main Sutlej has been dealt with separately, but in this report on the "Projected Bhakra Dam and other possible storage sites between the rivers Jumna and Chenab", it will appear, if you look at the map at the back of it, that there are many small sites on the affluents and the tributaries, on which small storages can be constructed. It seems desirable to take this opportunity of asking the Committee to pass an opinion, whether the Punjab might have a free hand in small storage schemes such as those given on pages 28 and 29 of the report.
852. The point is that on these affluents of the main river, it is only possible to store supplies at the height of the monsoon. The capacities are so small that they could not have any important effect by the time they reach the Indus.
853. I believe that the North-West Frontier Province also have a considerable number of small schemes of this sort, and it would save a considerable correspondence hereafter, if a decision could be arrived at, on such small schemes. In Table VI on pages 28-29 of the Report of the Committee on the Projected Bhakra Dam and other Storage Schemes, possible capacities are shown in column 9. For instance: taking the Beas, there is Nakehr which has storage capacity of 168,000 foot acres. It would appear that the construction of a small storage like that could not affect any main issue.
854. **Mr. Oram :** The schemes referred to in the North-West Frontier Province, were investigated chiefly on the Gomul river and the Tank Zam. The Gomul river catchment is about 14,000 square miles and the Tank Zam about 800 square miles. The proposals were investigated first for retarding basins only, and next for possible storage schemes both direct, *i.e.*, in the river valley itself, and indirect, by diverting high floods into side valleys.
855. All of these have been postponed indefinitely as the costs appeared to be unjustified by the benefit which the territories under the control of the North-West Frontier Province would obtain.
856. There is still the possibility of effecting some measure of conservation of floods in the Dera Ismail Khan District, as mentioned in connection with the regeneration from the proposed re modelling and extension of the Paharpur Canal.
857. There are other sites on affluents of the Indus, such as the Kurram, but these have not yet been investigated.
858. It is doubtful whether the expenditure involved will be such as to be reasonable in proportion to the benefits to be gained by the Province itself.
859. Perhaps the benefit of any such schemes, if they ever are undertaken, would be not only to a small Province, with very small areas within that Province on which to use water, but to other users of the Indus catchment yield, who may also be slightly benefited from the point of view of retardation and reduction of intensity of run off, of flood waters now running to waste.
860. **Sir Bernard Darley :** From this list it is seen that there are some storages which are very large.
861. **Mr. Nicholson:** They are on the main rivers and not on the affluents.
862. **Mr. Foy :** I regard this question of storage on tributaries as one of considerable and immediate importance and if the Committee could give a definite recommendation it would, I think, be advantageous. The reason for their immediate importance is that if it is decided to store water for the assistance of the Sutlej Valley Canals, the Bhakra scheme is of such magnitude and has so many complexities that it is not likely to be of such immediate help to the Sutlej Valley Project as some of these subsidiary storages which could very quickly be carried out.
863. **Mr. Trench :** I should like to say from my own point of view, that a certain number of works in recent years have been constructed which have had the tendency to increase the intensity of peak floods. Therefore I am not prepared on theoretical grounds to take exception to works which would have the opposite tendency and I would be prepared to agree to a statement that local Governments would not normally object to any small storage schemes designed to store water

during the months of July and August or thereabouts. I think it is very desirable that when these schemes are constructed the participating authorities in the river, should have early information. It tends to create an atmosphere of suspicion if no official information is received as to what is being done.

864. **Mr. Nicholson :** Could you state a figure up to which no objection will be made ?
865. **Mr. Trench :** During July and August there is practically no limit to which objection could be taken.
866. **Mr. Nicholson :** Can I take it that Mr. Trench would favour a storage on main rivers if they had a very marked retarding effect ?
867. **Mr. Trench :** I consider that in cases of small storages on affluents, they would not normally be filled except in years of good flood or that their effect would not be definitely detrimental. But I think it is rather extending the issue to apply my remarks really to major storage works which I think should be considered individually.
868. **Chairman :** I suggest that the following resolution be considered by the Committee :—
 “ This Committee declines to lay down any general opinion regarding subsidiary storage policy referred to by Mr. Nicholson, but suggests that each scheme should be considered on its merits and agreed to by the parties affected ”.
869. **Mr. Nicholson :** I suggest an amendment. After the word “ scheme ” insert “ exceeding a quarter million foot acres ”.
870. *After some general discussion the Chairman decided to resume consideration of this matter later.*
871. **Chairman :** We have discussed frankly and in considerable detail, the ten ISSUES. It is now necessary to pass to the particular points which are at issue between the Interested Parties.
872. We have not attempted to draft these points because we consider that the representatives of the Interested Parties should discuss them at an informal conference before we place anything on record. But we have attempted to suggest a basis for discussion of these points in the circular ⁽⁶⁰⁾ which has just been distributed.
873. There are several other matters on which decisions are required but if we are able to arrive at an amicable agreement regarding the five points included in the Circular, I feel confident that we shall be able to reach a decision on other outstanding matters, in a few hours. I suggest, therefore, at the conclusion of your informal deliberations, that the formal proceedings be re-opened, and any decisions which you have reached, should be recorded.
874. Six of the Members of this Committee are engineers of considerable experience and service and in the interests of our profession, Mr. Betterton and I trust that you will be able to settle amicably the conundrums before you. We fully realize that they are infinitely harder to solve than any cross-word puzzle, but in our profession we are accustomed to face difficult problems extending over a wide field. I believe I am correct in stating that irrigation engineers in this country have never failed to find a satisfactory and practical answer to every problem connected with our profession.
875. The problems now before you are professional matters of a highly technical nature and we are definitely of opinion that these problems should be settled by ourselves before this Committee breaks up. Should all our labour be in vain, then we anticipate that the Government of India will be compelled to refer the problems to another Committee, probably presided over by a High Court Judge. This would be a grave reflection on the Service of Engineers and with your hearty co-operation, my colleague and I are confident that this necessity will not arise.
876. Mr. Betterton and I propose to carry on our own work of examining the recorded proceedings and we will take no part in this informal discussion.
877. **The Chairman** *adjourned the meeting.*

878. *The Committee re-assembled at 9-00 a.m. on Friday the 8th. March 1935.*
879. **Chairman :** I understand that the Representatives of the Interested Parties have completed their labours and have come to an agreement which is to the satisfaction of all.
880. **Mr. Sladen :** I am not quite satisfied with my position.
881. **Chairman :** Your objection is noted, Mr. Sladen. Gentlemen ! we will resume our formal Committee meeting. The first business is to confirm the proceedings of Tuesday and Wednesday, 5th. and 6th. March.
882. *The report of the proceedings of the meeting held on 5th. and 6th. March 1935, was confirmed.*
883. **Chairman :** I now propose that we should conclude our discussion on the proposed recommendations regarding storage schemes.
884. **Mr. Nicholson :** I move the following resolution :—
885. “ This Committee is of opinion that small storage schemes of a capacity not exceeding half a million foot acres, on the affluents of the Indus and its five main tributaries for storage of water during the months of July and August may be undertaken by any local or state Government, without the formal sanction of any other party. But all other Interested Parties should be informed of the main details of the scheme prior to its being undertaken.
886. Any scheme exceeding the above capacity must have the prior approval of all Interested Parties.”
887. *There was a brief general discussion on the precise wording of the above resolution, which was finally passed unanimously as above.*
888. **Chairman :** Gentlemen ! I propose now to enquire the results of your informal conference, which started on Wednesday afternoon and finished yesterday evening.
889. **Sir Bernard Darley :** Mr. Chairman, may I explain that we formed ourselves into an informal sub-committee to consider the five points outlined in your circular ? When certain of the easier matters had been decided, the more contentious items were taken up for consideration. Messrs. Trench and Oram were not directly concerned with the Sutlej problem, but acted informally as assessors. I desire to propose a formal vote of thanks to Messrs. Trench and Oram for their patience and help during the sittings of our informal sub-committee.
890. *The proposal was carried unanimously.*
891. **The Chairman** directed that the sense of the Committee in this matter should be recorded.
892. **Chairman.:** I would refer you to item I of our circular, dated the 5th. March, 1935, in respect of Khairpur.
893. **Mr. Foy :** I acted as recorder on the first day. The Chairman may care to see my record.
894. **Chairman :** Will Mr. Betterton read out the sub-committee's record regarding Khairpur ?
895. **Mr. Betterton :** The sub-committee accepts the proposition that the irrigation of Khairpur State should be brought on the same basis as on the perennial channels of British Sind. Assuming that the culturable commanded area of 640,000 acres (including 40,000 acres shikargahs) put forward by Khairpur State are accepted, and that waterlogged areas are included as culturable, then (on the Sind Barrage water allowance of 4.2 cusecs at canal head per thousand acres culturable commanded area), the permissible head capacity as a perennial system would be—

$$\frac{640,000 \times 4.2}{1,000} = 2,688 \text{ cusecs}$$

against their present sanctioned capacity of 4,030 cusecs on their two feeders on a non-perennial basis.

896. There is an unsurveyed area of the State which lies on the Eastern Nara canal and has already been allotted a capacity of 400 cusecs on a non-perennial basis,

Converting this to a perennial basis the perennial capacity would be by proportionality—

$$\frac{400 \times 2,688}{4,030} = 267 \text{ cusecs}$$

897. In these calculations no consideration has been given to any rice areas, any change on this account will not affect the conclusion appreciably. This change in capacity will affect the total authorized withdrawals at the Sukkur Barrage in both kharif and rabi, as will be referred to later when dealing with item (2). The sub-committee has not worked out in detail the monthly permissible withdrawal on the Sind basis. This is purely a matter of routine.
898. **Chairman :** Do you agree to this, Mr. Sladen ?
899. **Mr. Sladen :** When I asked Mr. Nicholson whether the figure of 2,688 cusecs was to be reduced by any capacity factor, he said 'no', but from the last remark read out by Mr. Betterton just now it appears that it will be reduced as a matter of routine. What I want the Committee to accept is a figure which will free water at times when it is least required by others and will give it to us, when there is no shortage.
900. I want the capacity factor fixed monthly, giving the average monthly mean of 2,688 cusecs. It enables the State to use its water more economically in so far as the water is concerned. It also enables the State to be economical in regard to its finance because we have these feeders in existence and we want to work them to the Sind basis, by remodelling them, as well as our internal distribution.
901. The figures that I have suggested which give an average monthly mean of 2,688 are—800 in April, 2,250 in May, 3,000 in June, 4,000 in July, August and September, 3,200 in October, 2,500 in November and December and 2,000 in January, February and March. You will see from this that we will make more water available in the months of January, February, March, April and May.
902. **Chairman :** Do you accept the statement that the allotment of water to Khairpur should be precisely on the same footing as that of Sind ?
903. **Mr. Sladen :** I do not accept this statement. I should like to have the allotment of water on the basis of the figures that I gave just now.
904. **Chairman :** What are your views, Mr. Trench ?
905. **Mr. Trench :** I consider that the resolution as it stands justifiably might not be strictly interpreted owing to the existing conditions as regards Khairpur.
906. The advantage that we gain is very considerable. We free water in certain very low months and additional water is given when it is generally ample up to the commitments which we have in those months already. It really comes to this that, whereas there is a varying capacity factor in other canals between seasons, Mr. Sladen asks for a varying capacity factor not twice a year but 12 times a year and I think it is fairly reasonable. I am not prepared to oppose it.
907. **Chairman :** The distribution of water between Sind and Khairpur should be settled between themselves. It is a purely domestic matter between Sind and Khairpur.
908. **Mr. Nicholson :** We are considering the waters of the Indus as a whole. The point is whether Khairpur canals are going to be perennial or non-perennial. Sind cannot say to Khairpur that they can have a perennial canal with 4,000 cusecs as this will alter their capacity and supplies available in the river.
909. **Mr. Trench :** It cannot be considered as perennial because it comes to full capacity only during certain months.
910. **Mr. Sladen :** We want more water during the three months of the year July, August and September, in none of which is there any shortage. We can utilize this water instead of allowing it to go waste to the sea.
911. **Mr. Nicholson :** There are two capacities : one the perennial capacity and the other as now demanded in a non-perennial canal. If we agree to this it means they will develop prescriptive rights to the excess draw-off.
912. **Mr. Sladen :** I don't think the Punjab practice applies here entirely. We ask for more water only during the three months July, August and September. It will enable the State to utilize the water more usefully and economically.

913. **Chairman :** Your objections, Mr. Sladen, have been noted. Let us pass on to item No. II, which relates to Sind.

914. **Mr. Betterton :** *reading proceedings of Sub-Committee.*

" RABI.

The sub-committee found from a study of the records of discharges at Sukkur in the rabi from November to March that it was only in exceptional years that withdrawals contemplated for the Sukkur Barrage project (including a conversion of the Khairpur channels to a perennial basis), the Thal project and the Paharpur extension on the Indus, and the modifications of the Haveli (Trimmu) and Panjnad Headworks (withdrawals on the Chenab), would not be fully met. Any insufficiency of supply would be so small that it would not cause any difficulty.

915. On the Indus the Thal project would share any possible shortage rateably with the Sukkur Barrage canals on the rabi authorized capacities of the channels. This would occur only on rare occasions for a few days.

916. **KHARIF.**

The sub-committee found that the total additional demands over present utilizations is between eleven and twelve thousand cusecs from which must be deducted, the amounts used at present in the inundation canals on the Chenab. These amount in the kharif months to the figures given in the accompanying schedule ⁽⁶¹⁾ for the years 1922 to 1934 and would be of particular importance during September to the inundation canals in Sind from the point of view of the levels of the river water surface rather than as regard actual supplies. As regards the inundation canals in Lower Sind an additional credit would have to be given for any reduction of the kharif discharges for the Khairpur canals consequent on their conversion to perennial.

917. The Government of Bombay have already agreed to an Haveli project with a total kharif capacity of 7,500 cusecs, and the total additional demands above that figure required for all projects now contemplated including revisions, comes to about three thousand nine hundred cusecs from which must further be deducted the total actual withdrawals of the inundation canals which have a capacity of 9,636 cusecs now proposed to be replaced by the Haveli project.

918. In addition further discharges set free by the conversion of the Khairpur canals to a perennial basis must be deducted from this figure to estimate the effect on the Lower Sind canals.

919. These calculations are based on the assumption that these project canals and the Panjnad Canal will work at a capacity factor of unity, *i.e.* run full maximum authorized capacity throughout the entire kharif season. This does not in fact occur in actual practice on any canal, so that these are the most adverse conditions that can possibly result.

920. The calculations also take no account of the fact that a withdrawal in the upper reaches of a river is not completely reproduced in the lower reaches.

921. The sub-committee further agree to recommend that the Sukkur Barrage canals, apart from the changes consequent on the conversion of the Khairpur canals to perennial, should be allowed to increase their authorized withdrawals in the month of October by 6,500 cusecs to remedy the non-inclusion on the Eastern Nara and the North-Western and Dadu canals of the requirements for kharif crops in that month.

922. To sum up it would appear that even if all changes proposed were brought into operation at once, the effect of the additional net withdrawals beyond those to which the Government of Bombay are already committed, would be negligible".

923. **Mr. Trench :** I want to put in a definite statement in regard to the October supplies. Here is an analysis regarding all the canals.⁽⁶²⁾

924. **Mr. Foy :** In addition to this statement, there is a statement ⁽⁶³⁾ which is being typed. This statement compares the proposals for the Thal, Haveli and the Panjnad withdrawals.

(⁶¹) Appendix XV.

(⁶²) Appendix XVI.

(⁶³) Appendix XVII.

925. *Sir Bernard Darley, Messrs. Nicholson and Sladen intimated their acceptance.*
926. **Mr. Sladen :** There is just one other solution about taking anything over the authorized supplies. It is enough if we are allowed to take what we want up to 4,000 in those three months for a period of say five years in order to enable us to get on with remodelling. This I might be willing to accept, but at the same time, I think the other solution is more reasonable.
927. **Chairman :** We can go back to item No. 1 later.
928. *The Committee unanimously intimated their acceptance of the recommendation of the sub-committee on item No. II.*
929. **Chairman :** Let us go to item No. III relating to the Sutlej.
930. **Mr. Betterton :** *reading*

SOLUTION OF THE GHARRA AND PANJNAD CONUNDRUMS.

(1) "It was agreed that the capacities of the perennial canals in the Gharra Reach shall be—

Punjab.	Bikaner.	Bahawalpur.
3,940	2,720	6,340
giving the following percentages		
30	21	49

(2) That the kharif non-perennial and total capacities and percentages shall be as shown below :—

	Perennial.	Non-perennial.	Total.	Percentage.	Rounded to.
Punjab ..	3,940	11,523	15,463	53.3	53%
Bikaner ..	2,720	Nil	2,720	9.4	10%
Bahawalpur ..	6,340	4,467	10,807	37.3	37%
	13,000		28,990		

931.⁽⁶⁴⁾ (3) (a) Up to a River Discharge which would give at Perennial Canal heads $1/3 + 1/10$ of distributary head capacities the rabi percentages shall apply.

(b) That river discharges in excess of that amount shall go to the non-perennial canals until they draw the same (fractions of their distributary capacities).

(c) When the river discharge exceeds this amount the kharif percentages shall apply.

932. (4) It was agreed that :—

the Punjab and Bahawalpur capacities for their canals from Haveli and Panjnad should be as follows :—

	Perennial.	Non-perennial share capacity.	Maximum capacity.
Panjnad ..	1,500	4,333	6,500
Haveli ..	2,750	..	5,000

933. (5) Bahawalpur and Punjab agreed that clause 4. D. 2 of the 1920 Agreement be revised so as to remove the restriction imposed on the utilization of the Chenab supplies (by them).

934. Present (1920) and proposed Head Capacities.

Partner.	Pre-sent.	Bikaner pro-posed.	Differ-ence.	Bahawal-pur pro-posed.	Differ-ence.	Punjab pro-posed.	Differ-ence.	Compro-mise reached.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Punjab ..	3,440	4,446	1,006	3,861	421	4,179	739	501*
Bikaner ..	2,144	3,250	1,106	2,626	482	2,642	498	576
Bahawalpur ..	7,416	5,304	—2,112	6,513	—903	6,184	—1,232	—1,077

* Bahawalpur offered to split the difference between 903 and 1,232—1,077 thus offering another 174 cusecs. This was divided between Punjab and Bikaner in the proportion of 421 : 482 (*vide* column 6) giving Punjab 80 cusecs extra and Bikaner 94 extra."

935. **Chairman :** Will you kindly explain, Mr. Trench ?
936. **Mr. Trench :** The above recommendations cover items Nos. III, IV and part of V of your circular.
937. The method by which the head capacities were arrived at, are stated at the end, which shows the different proposals which were put up by the different Parties and how the compromise was arrived at. These figures for the capacities are brought forward to the beginning of the statement just read by Mr. Betterton, and the actual figures are Punjab 3,940, Bikaner 2,720 and Bahawalpur 6,340. The statement gives the percentages also rounded off. Actually Bikaner gets 20·8 but it has been taken at 21.
938. When the non-perennial problem was tackled, the non-perennial capacities were left as they were.
939. **Sir Bernard Darley :** Yes. They were altered according to the Bahawalpur suggestion and were added to the perennial in order to get the total capacities.
940. **Mr. Trench :** Yes. It gives the perennial 53·3, 9·4 and 37·3%. Due to a gesture on the part of Punjab and Bahawalpur the two fractions of ·3 in the Punjab and the Bahawalpur fractions were lumped together and added to the Bikaner fraction to round percentages. That is to say 0·6 of the total discharge of 28,990 was added to Bikaner for the kharif capacity, which amounts to 174 cusecs.
941. The next question which was considered was the way of dealing with the early kharif supplies and it was agreed that they should be dealt with in the way shown in (a), (b) and (c) of paragraph (3) ⁽⁶⁵⁾. I do not think there is anything particularly to be said about it.
942. Coming to the Panjnad share, that was adjusted also as between Punjab and Bahawalpur by admitting that the perennial canal capacity should be 1,500 cusecs in future and the combined should be 8,000.
943. **Sir Bernard Darley :** I think that in the final resolution we should lay it down that it was agreed that the capacities of the Haveli and the Panjnad canals should be as shown and that the water should be divided accordingly.
944. **Mr. Nicholson :** There is one point here. On the Haveli we haven't differentiated between any share capacity and the maximum capacity.
945. **Mr. Trench :** As between Bahawalpur and Haveli, the only meaning of getting out the capacities was the use for sharing purposes.
946. **Mr. Nicholson :** The difficulty about the distribution at Panjnad and Haveli is that the existing rights for the Sidhnai perennial area and the infiltration below the Trimmu headworks to Panjnad on a mathematical basis might be incapable of physical application.
947. Regarding the distribution of supplies at Trimmu and Panjnad it was suggested that Mr. Gunn should work out from the existing data and hydrographs, the result of applying any suggested distribution schemes so that the Independent Members may see the results obtained and give their recommendations accordingly, I agree to accept them.
948. I am of opinion that the share capacity for the Panjnad canal should be stated on the grounds that it is still a portion of the Sutlej Valley Project. Sir Bernard Darley, on the other hand, is of opinion that the share capacity should be fixed both for the Haveli and the Panjnad canals or, alternatively, that both should be struck out. The INDEPENDENT MEMBERS will make their own recommendation in regard to the distribution, which I agree to accept.
949. **Sir Bernard Darley :** I also.
950. **Mr. Trench :** The full supply capacities as now fixed were to form the basis for distribution of supplies, the precise form of this distribution to be left to subsequent examination of the data.

951. *The Committee unanimously intimated their acceptance of the general recommendations of the sub-committee on items III and IV as recorded above, subject to the reservation on minor points, also recorded.*
952. **Chairman :** We will now pass on to No. V of the circular. I note that a portion at least, of this item has been included in the general settlement of the Sutlej question.
953. **Mr. Betterton, reading proceedings of sub-committee :—**
KHARIF PERIOD.
 “ It appears to be the general view of the sub-committee that the kharif period in the west Punjab and Sind, which excludes the Gharra reach of the Sutlej, is approximately fifteen days later than in the rest of the Punjab. It is proposed that for all purposes the kharif period should be fixed from the 15th. of April to the 31st. of October, and that changes in authorized shares should take place on these dates. ⁽⁶⁶⁾ But that if supplies are surplus at Sukkur a non-perennial channel may withdraw water from 1st. April but shall have no claim against supplies switched to the Sutlej from the Western Rivers. This will apply to canals above Mithankot; below Mithankot, Sind to retain existing practice as in 1919 Sukkur Project.”
954. **Chairman :** I take it that the special circumstances in the Gharra reach led to general acceptance of the principle of making the state of the river responsible for determining the date of opening of non-perennial channels. For the rest of the systems concerned, the sub-committee's recommendation is accepted?
955. *The Committee unanimously intimated their acceptance of the recommendations of the sub-committee on item No. V.*
956. **Chairman :** I suggest that we now discuss any other subsidiary matter still outstanding.
957. **Sir Bernard Darley :** I propose that when once supplies (both perennial and non-perennial) have been allotted to any party, that party should be permitted to use such supplies as they wish.
- In Bahawalpur, we are subject to very severe frosts. Some crops, e.g., gram and peas are very severely hit by frosts. Watering immediately after a frost saves the crop. This year when our crops were frost-bitten, fortunately we had a fall of rain which saved them. Last year, I wired to the Chief Engineer of the Punjab and with his permission, we opened the Fordwah canal for ten days during the rabi and thus saved quite a considerable part of the area from destruction. Later, at one of the Water Distribution Committee meetings, this question was discussed and it was decided that it should not be permitted again and that is the reason why I wish that this should be one of the recommendations of this Committee.
958. *General discussion (not recorded) ensued and the following resolution was framed :—*
959. “ No non-perennial canal or non-perennial area shall rank for claiming supplies during the rabi period. Subject to this restriction, a partner may utilize his perennial water in any area which he thinks fit.”
960. *All members of the Committee accepted this resolution except Mr. Foy, who did so, subject to the ratification of the proceedings of the sub-committee regarding the re-distribution of water on the Gharra reach of the Sutlej.*
961. **Chairman :** Before concluding, this Committee desires to record its views on two prominent features of the enquiry.
962. *Firstly.* The Committee invites attention to the detailed records on all aspects of the problem which have been kindly placed at their disposal by Mr. Nicholson (Punjab). But for Mr. Nicholson's grasp of all details of the problem and his encyclopædic knowledge of the records, we feel that the time occupied in the examination of the problems before us would have been far greater and that possibly an agreed and unanimous decision might not have been reached.
963. *Secondly.* One of the outstanding features of our proceedings has been the acceptance by every representative of the records of river discharges, placed at our disposal by Mr. Gunn (Executive Engineer, Discharge Division) who accompanied Mr. Nicholson. We are confident that, but for the information so obtained, it would have been impossible for this Committee to reach any conclusion as to the

(⁶⁶) Modified subsequently : See footnote No. 64.

adequacy of the water supply at the key points on the Indus and its tributaries. We record our opinion that the work of the Discharge Division has been of the utmost value and importance.

964. We record our concurrence with the views of Sir Thomas Ward expressed in 1921, that each Province interested in water supplies should maintain some organization, continuously to keep records of this nature. As questions of water supplies become of greater importance with India's development, authentic records of this nature become more and more essential to the solution of these problems. We congratulate the Punjab Government on their enterprise in this respect and trust that the organization now in being will continue this most valuable—indeed we may say essential—work.
965. *The Committee passed the above resolutions unanimously.*
966. **Sir Bernard Darley :** May I propose a hearty vote of thanks to our Chairman for the most patient way in which he has heard our difficulties and the manner in which he has discharged his duties. It is largely due to him that we have come to these unanimous decisions.
967. **Mr. Nicholson :** I would like to second this proposal.
968. *The proposal was carried unanimously.*
969. **Chairman :** I thank you all very heartily and congratulate you on the success of your labours. The only thing we have to do this afternoon is to correct the proceedings of this morning.
970. **Sir Bernard Darley :** Without prejudice to any action that may be taken on the recommendations of this Committee, the Panjnad canal may be permitted to draw off from the 15th. April a maximum discharge of 8,000 cusecs throughout the coming kharif season or until such time as any further restriction is placed upon it ?
971. **Mr. Nicholson :** The Punjab Government may be informed that supplies as asked for by them for the Haveli Project are guaranteed. The information will enable them to take necessary action in respect to construction.
972. **Chairman to Secretary :** Please take instructions this afternoon regarding the preparation of an Interim Report.
973. *The Chairman adjourned the meeting till 4-30 p.m. of the same date.*
974. *The Committee re-assembled at 4-30 p.m.*
975. **Chairman :** Our business this afternoon is to correct this morning's proceedings.
976. **Mr. Trench :** I desire that the following note should be added to the record of proceedings of the informal sub-committee, which have been brought on the record this morning :
977. "The additional authorized withdrawals at the Barrage for the Sukkur canals in the month of October, demanded by the Bombay representative, have been accepted by all parties".
978. **Chairman :** Are you all agreed to Mr. Trench's addendum being brought on the record as accepted ?
979. *The Committee unanimously intimated their acceptance of the addendum.*
980. **Mr. Sladen :** I should like it to be recorded that agreement has been reached between Mr. Trench and myself for adjusting the draw-off of Khairpur feeders, in accordance with my remarks on this head, this morning. I have handed in a statement.⁽⁶⁷⁾
981. **Chairman :** Subject to the above notes, does the Committee unanimously accept the record of this morning's proceedings ?
982. *The Committee unanimously intimated their acceptance of the record.*
983. **Chairman :** The meeting is adjourned *sine die*.

Second Meeting.

984. Owing to the large number of dissenting notes on the draft report of the Committee circulated for approval the Chairman decided to hold another meeting in order to discuss further some of the points upon which the decisions were not unanimous.

985. The following Members therefore met at Simla on the 17th. June for further discussion :—

Mr. F. ANDERSON, C.I.E., I.S.E., <i>Chairman</i>	..	Nominated by the Government of India.
Mr. F. A. BETTERTON, I.S.E.	.. ..	Do.
Mr. W.L.C. TRENCH, I.S.E.	.. ..	Sind.
Mr. H. W. NICHOLSON, C.I.E., I.S.E.	.. ..	Punjab.
Sir BERNARD DARLEY, Kt., C.I.E.	.. ..	Bahawalpur.
Mr. J. BOOTH, I.C.S.	.. ..	Khairpur.
Rai Bahadur JAI GOPAL	.. ..	Bikaner.

Mr. M. T. Gibling, I.S.E., Secretary, Central Board of Irrigation acted as Secretary to the Committee. Messrs. Sladen and Foy who attended the first meeting were now in England and their places were taken by Mr. Booth and Rai Bahadur Jai Gopal.

The Committee met at the Assembly Hall at 10 a.m. on the 17th. June, 1935, and the Chairman opened the proceedings.

986. **Chairman:** Gentlemen, the many dissenting notes received on the draft report have altered the circumstances, and it is for that reason that this meeting has been called to-day to try and obtain a unanimous report from the Committee as a whole. The original report, which was circulated, was drafted more or less by Mr. Montagu with the assistance of Mr. Betterton and myself. Now that was purely a draft skeleton report and was not intended to be a final report at all. The report was sent out to Members of the Committee in order to obtain their views and endeavour to obtain as far as possible a unanimous report. After the submission of a number of dissenting notes, this meeting has been called to consider that report. There are now two points before you :

should we consider the original draft report as sent to you about two months ago, or

should we consider the revised draft report which Mr. Gibling has very kindly re-drafted for us ?

The third alternative is :—

should we consider the ISSUES received from the Members of the Committee ?

Personally, I am of opinion, and Mr. Betterton agrees with me, that the second draft report, as prepared by Mr. Gibling, should be considered paragraph by paragraph. I should like the opinion of the members of this committee on the procedure we should adopt. I recommend that the second draft report prepared by Mr. Gibling should be considered paragraph by paragraph.

987. *It was agreed to discuss the second draft Findings and Recommendations.*

988. **Chairman:** Paragraph 3. 1 and 2 do not matter.

989. *Paragraph 3 read as follows :—*

“ The Committee are of the opinion that the irrigation of Khairpur State should be brought on the same basis as that of the perennial canals of British Sind. They accept the figure of 640,000 acres as the culturable irrigable area of the State ; this includes 40,000 acres of Shikargah which the Committee are prepared to include in the area for which perennial water should be supplied. On the basis of 4.2 cusecs per 1,000 acres culturable irrigable area this would require a capacity at canal head of 2,688 cusecs. On the same basis they further agree to the allotment of a perennial supply of 267 cusecs to the State area to be irrigated from the Eastern Nara Canal to which a non-perennial supply of 400 cusecs was previously allotted.”

990. **Chairman:** No discussion I think is necessary up to the point “ for which perennial water should be supplied ”, that was accepted unanimously by the committee.

991. **Mr. Booth :** Irrigation in Khairpur will not be on the same basis as British perennial canals. The agreement between Mr. Sladen and Mr. Trench was not on the same basis.
992. **Chairman :** The wording of the finding passed by the Committee in March was "on the same basis as the perennial".
993. **Mr. Booth :** Yes.
994. **Mr. Trench :** The Khairpur canals have been allotted varying supplies throughout, so that it is not on the same basis.
995. **Chairman :** The point is whether Table I attached to the Interim Report ⁽⁶⁸⁾ is accepted by the Committee.
996. **Mr. Nicholson :** The fundamental basis was accepted. This Table was put in subsequently. Does this correctly represent the interpretation of the principle? The figure of 4.2 was based on figures given by Mr. Trench which do not appear on the record, and we should show without doubt what the basis is.
997. **Chairman :** I think Khairpur and Sind should modify paragraph 3 and put up a redraft tomorrow.
998. *A discussion then followed as regards the demands of Khairpur, and Table I of the Interim Report.*
999. **Mr. Booth :** The Committee accepted the principle that we should be given a perennial supply. We are now giving up a certain amount of the rabi supply agreed to, in exchange for an increase in the kharif supply.
1000. **Mr. Nicholson :** Do you ask for a perennial supply on the same basis as Sind?
1001. **Mr. Booth :** The Rohri canal has been designed for this purpose, whereas our canals are not.
- * * * * * * * *
- * * * * * * * *
1002. **Mr. Nicholson :** As things stand at present, there is no scientific basis.
1003. *The Chairman then referred to paragraph 109 of the proceedings at page 11 and read out Mr. Sladen's remarks.*
1004. *Paragraph 4 was then considered.*

Paragraph 4.

"If Khairpur State irrigation is brought on to a perennial basis then the maximum authorized discharges must be reduced in the months of May to September. The Committee do not propose, however, to reduce the authorized withdrawals at Sukkur on this account, particularly as it would facilitate an agreement as to the precise method of distribution between British and State canals at Sukkur".

1005. **Mr. Nicholson :** I suggest in line 1, that "the" be replaced by "its", and in line 3, the word "authorized" be replaced by the word "maximum".
1006. *It was decided that a Sub-Committee of Messrs. Booth, Nicholson and Trench should look into paragraph 3, that figures should be produced by Mr. Nicholson and that they should if necessary, put up proposals for modification of paragraphs 3—7 the next day.*

Paragraph 8.

"The Committee consider that the waters of the Indus proper only should be allotted to the Sind, Thal and Paharpur canals. They agree to a capacity for the Thal project canals of 6,000 cusecs with a rabi capacity factor of 0.6, and a mean rabi supply of 3,600 cusecs".

1008. *After some discussion this was re-drafted and accepted as follows :—*

"The Committee agree to a capacity for the Thal Project canals of 6,000 cusecs with a rabi capacity factor of 0.6, and a mean rabi supply of 3,600 cusecs."

1009.

Paragraph 9.

"The newly proposed Paharpur canal requires a maximum supply in kharif of 875 cusecs with a mean discharge of 500 cusecs, and a maximum rabi supply of 700 cusecs with a mean of 360 cusecs, to which the Committee agree".

1010. **Mr. Nicholson** : After the word "requires" add the words "for the irrigation of the North-West Frontier and Punjab tracts". This comes in under paragraph 240 of the Proceedings.

1011. *The amended draft was then accepted.*

1012.

Paragraph 10.

Proc. 915. "In the event of the supply in the Indus proper being insufficient the Thal and Paharpur canals will share any shortage with the Sukkur Barrage canals on the basis of their authorized maximum withdrawals".

1013. *It was decided to add :—*

"They consider that the Haveli and Panjnad canals should have a prior claim on the waters of the Panjnad up to their authorized withdrawals. In the event of any shortage at Sukkur the Haveli and Panjnad would not be called upon to forego their right to any water up to their authorized withdrawals".

1014. *One other change was made, and paragraph 10 as amended below was accepted.*

Proc. 915. "In the event of the supply in the Indus proper being insufficient the Thal and Paharpur canals will share supplies available during any period of shortage with the Sukkur Barrage canals on the basis of their authorized maximum withdrawals. They consider that the Haveli and Panjnad canals should have a prior claim on the waters of the Panjnad up to their authorized withdrawals, and therefore they would not share in any shortages of the Indus."

1015. *Paragraph 11 was then considered.*

Paragraph 11.

Proc. 914. "The Independent Members while agreeing with these Findings recommend that the maximum monthly authorized withdrawals be fixed month by month for these three projects, and they consider that any shortages in the Indus proper supplies should be shared by those projects in proportion to the authorized maximum withdrawals in the particular month or months concerned. The Independent Members find, however, from records placed at their disposal that it would be in exceptional years only that the total requirements of those projects would exceed the supplies available and any deficiency of supply would ordinarily be so small that it would create no difficulty."

Chairman : In line 3 the words "three projects" will have to be changed and the names will have to be specified, viz., Paharpur, Thal and Sukkur.

1016. **Mr. Nicholson** also suggested the following amendment in line 3. For the words "any shortages" substitute "during any period of shortage".

Paragraph 11 as amended was then accepted.

1017.

Paragraph 12.

"The Committee recommend that the supplies in the Chenab be shared between the Haveli project when it is constructed, and the Bahawalpur canals taking-off at Panjnad, and the latter should in future have no claim whatsoever on Sutlej Waters, except for regeneration below Islam weir which will be included in the available supplies at Panjnad."

1018. *Accepted by Mr. Nicholson.*

1019. **Sir Bernard Darley** : Does the Committee agree that were it physically possible the waters of the Chenab and Panjnad should be shared between Haveli and Panjnad strictly according to their maximum capacities?

1020. **Mr. Nicholson** : That question is outside the discussion. It was left to the Independent Members and they had made their award.

1021. **Sir Bernard Darley** : It was verbally agreed that you and I should discuss this question and that if we could not come to an agreement we would leave it to the Independent Members.

1022. **Mr. Nicholson :** The record shows that we definitely left it to the Independent Members, I refer to paragraph 947 of the Proceedings.
1023. **Sir Bernard Darley :** The main issue before the Committee is—assuming that it were physically possible that the water could be shared according to the maximum capacities, do the Committee agree to this in principle? I do want this Committee to give a clear cut decision instead of having to refer this to a second Committee if necessity arises.
1024. **Mr. Nicholson :** After what has been stated in paragraph 35 onwards of the original Findings and Recommendations, I do think it is rather a pity to endeavour to break up a decision which the Committee had already agreed to.
1025. **Chairman :** It was only a draft and was never intended to be final.
- * * * * *
1026. **Mr. Nicholson :** In the case of the Panjnad the question of water-logging apparently is not of material weight, but in the case of the Haveli it is. I do think that the monthly requirements for the Panjnad should be filled in.
1027. **Sir Bernard Darley :** Do the Committee agree that the available supplies should be shared according to maximum capacities or mean monthly requirements?
1028. **Mr. Nicholson :** Mean monthly requirements. The fixing of mean monthly requirements should bear some relation to existing practice. We presume we are talking about rabi now.
1029. **Mr. Trench :** I think this issue should be decided on the maximum of the withdrawals during the two seasons—that they should be shared on the basis of the kharif capacity of the kharif and the rabi capacity of the rabi.
1030. *The discussion then turned to paragraph 16.*

Paragraph 16.

“ If, however, it becomes apparent that either of the Haveli or Panjnad canals is not receiving the same proportion of its authorized capacity as is the other, then the method of distribution must be revised and a water account maintained as on the Sutlej, water being shared according to the monthly authorized maxima ”.

1031. **Mr. Nicholson :** I accept paragraph 16 *in toto* as far as the word “ Sutlej ” and I would let it end there. I am doubtful whether the rest of the paragraph would solve the problem.
1032. **Chairman :** We have not come to any decision regarding paragraph 12. ⁽⁶⁹⁾ I thought it had been accepted without discussion.
1033. **Mr. Nicholson :** I suggest that in the first line of paragraph 12 after “ Chenab ” the words “ at Panjnad ” be inserted and for the words “ and the latter ” etc. the following be substituted :—
- “ and the latter should in future have no restriction placed on its withdrawals based on the supplies available in the Sutlej and the restriction of paragraph 4 of the 1920 Sutlej Valley Agreement.”
1034. *It was decided to put a semi-colon after “ Panjnad ” and omit the second “ and ”, and keep the paragraph as it was with this alteration.*
1035. *Sir Bernard Darley wished to make a further addition to this paragraph and he was asked to draft the addition and put it before the Committee the next day.*

Proceedings of the second day (June 18, 1935).

1036. *The Committee took up for discussion the amended drafts of paragraphs 8, 9 and 10.*

Paragraph 8.

“ The Committee agree to a capacity for the Thal project canals of 6,000 cusecs with a rabi capacity factor of 0.6, and a mean rabi supply of 3,600 cusecs.”

Paragraph 9.

“ The newly proposed Paharpur canal requires for the irrigation of the North-West Frontier and Punjab tracts a maximum supply in kharif of 875 cusecs with a mean discharge of 500 cusecs. and a maximum rabi supply of 700 cusecs with a mean of 360 cusecs, to which the Committee agree.”

Paragraph 10.

"In the event of the supply in the Indus proper being insufficient, the Thal and Paharpur canals will share supplies available during any period of shortage with the Sukkur Barrage canals on the basis of their authorized maximum withdrawals. They consider that the Haveli and Panjnad Canals should have a prior claim on the waters of the Panjnad up to their authorized withdrawals, and therefore they would not share in any shortages of the Indus".

1037. Mr. Trench : In paragraph 10, the words "on the basis of their authorized maximum withdrawals" are not clear. Does that mean authorized maximum throughout the year or authorized withdrawals in the months concerned? In paragraph 11 it is made clear.

1038. Chairman : It means, during the period of shortage.

1039. *It was decided to add the words "for the period concerned" after "maximum withdrawals" in paragraph 10 and the amended paragraphs 8, 9 and 10 were then accepted.*

1040. *Paragraph 11.*

"The Independent Members while agreeing with these findings recommend that the maximum monthly authorized withdrawals should be fixed month by month for the Sind, Paharpur and Thal canals and they consider that during any period of shortage in the Indus proper, supplies should be shared by those projects in proportion to the authorized maximum withdrawals in the particular month or months concerned. The Independent Members find, however, from records placed at their disposal that it would be in exceptional years only that the total requirements of those projects would exceed the supplies available, and any deficiency of supply would ordinarily be so small that it would create no difficulty".

The amended draft was accepted.

1041. *Paragraph 12.*

The following re-draft by Sir Bernard Darley was taken up.

"The Committee recommend that the supplies in the Chenab at Trimmu and Panjnad be shared between the Haveli project when it is constructed, and the Bahawalpur canals taking off at Panjnad; the latter will have no claim whatsoever on Sutlej Waters, except for regeneration below Islam weir which will be included in the available supplies at Panjnad. When the indents of these two canals cannot be met the available water should be shared, as far as physically possible, strictly on a basis of their capacities or authorized full supply discharges. For this purpose the year should be split into the periods noted below and water accounts maintained. Each canal should receive its fair share of water during these periods :—

Rabi.

1st. November to 30th. of November.

1st. December to 14th. of February.

15th. February to 31st. of March.

Kharif.

1st. of April till river rise to meet indents.

20th. September or date from which river falls until 15th. October.

For the period 16th. to 31st. October after the demands of the perennial canals have been met, the non-perennial canals should share the balance of water according to the full capacities of those canals.

The full capacities agreed to are :—

—				Perennial.	Per cent.	Non-perennial.	Per cent.	Total	Per cent.
Haveli	..	..	..	2,750	65	5,000	44	7,750	48
Panjnad	..	..	..	1,500	35	6,500	56	8,000	52

1042. *The following verbal amendment under "Kharif" was made. For the words "river rise", substitute the words "river rises sufficiently".*
1043. **Mr. Nicholson :** As regards the mean monthly withdrawals in Table III (amended) ⁽⁷⁰⁾ I should like to know on what these figures were based.
1044. **Sir Bernard Darley :** It is largely a shot in the dark.
1045. **Mr. Nicholson :** I suggest that these are proportionately higher than are proposed for the Thal project. So the Thal should be treated on the same basis and there should be no differential treatment. Either the Thal should be brought up or these means should be brought down.
1046. **Sir Bernard Darley :** The capacity factors that I have put down for the months of October and March are exactly the same as for the Haveli project.
1047. **Chairman :** What is your main point, Mr. Nicholson ?
1048. **Mr. Nicholson :** The point is this. In the amended Table No. III the withdrawals now asked for in column 5 by Sir Bernard Darley are on the basis of monthly capacity factors in excess of those which have been accepted for the Thal Project. The Thal and the Panjnad are two straight projects which are not complicated by the question of water-logging and the necessity of working wells. In the case of Haveli, however, the question of water-logging arises, and there is the desire to restrict irrigation supplies during the middle of the rabi crops so as to ensure the continuous working of the six thousand wells which already exist in the tract to be perennially irrigated. Furthermore, it will be very difficult to expect the Punjab Government to accept preferential treatment for the Panjnad after what has been accepted for the Thal. It seems reasonable that the same monthly capacity factors should apply to the Panjnad as the Thal.
1049. **Sir Bernard Darley :** Why should Haveli get preferential treatment ?
1050. **Mr. Trench :** I have more objection to an increase in the Thal than in the case of the Panjnad, because I realize that the water in the Indus is generally there, whereas in the Panjnad very often it will not be there.
1051. **Mr. Nicholson :** All I ask for is equal treatment for the two projects, the Thal and the Panjnad, and if you can get the same treatment for both, I shall be perfectly content.
1052. **Sir Bernard Darley :** I see no necessity to have a mean monthly discharge.
1053. **Mr. Trench :** One of the reasons for approving the higher discharge in March for Haveli beyond that which was originally approved by the Government of Bombay is that in December, January and February the discharge is proposed to be cut down.
1054. **Sir Bernard Darley :** I accept that. Then put up the Haveli to the same figures as for the Panjnad.
1055. **Mr. Nicholson :** I repeat again that all I ask for is equal treatment.
1056. **Sir Bernard Darley :** As Mr. Trench wishes that there should be mean monthly capacity factors, then I accept this : I do not know how the capacity factors were fixed for the Thal, but they are lower during certain months in the year than those actually in practice on the existing Punjab canals. The lowest capacity factors to which I think we could work efficiently on the Panjnad canals are :—

October ..	..	..	..	..	..	..	..	1.0
November ..	..	..	..	..	..	..	..	.9
December ..	..	..	..	..	..	..	..	.5
January ..	..	..	..	..	..	..	..	.5
February ..	..	..	..	..	..	..	..	.66
March ..	..	..	..	..	..	..	..	.75

I previously suggested higher figures than these, so that they might compare more evenly with the Haveli canal taking into account the fact that they had simply lowered the capacity factors for December, January and February to .3 on account of the number of wells which they wished to force into operation. All I have always asked for is that the Panjnad should be treated on similar lines to the Haveli as far as this is possible. If the Punjab Government consider that it is necessary to force people to work their wells during the months of December, January and

February, I do not think this is a reason why the Panjnad canal should be forced to have a lower capacity factor during those months, seeing that there are very few wells in the perennial area served by the Panjnad canals. I therefore, suggest that the Haveli canals should be given the capacity factors which I have now proposed as the lowest to which the Panjnad canal can work to, and if they wish to cut this down by executive order during the months of December, January and February, their Government can do so.

1057. **Mr. Trench** : As regards the capacity factors for Panjnad, I agree that the ones Sir Bernard Darley has proposed are fair.
1058. **Mr. Betterton** : What exactly is your comment on Sir Bernard Darley's proposal ; to have the same capacity factors in Haveli as in the Panjnad ?
1059. **Mr. Trench** : One of my main reasons for accepting higher discharges than those already accepted by Bombay for the Haveli Project during part of the rabi season is that in the three months they have been voluntarily cut down.
1060. **Mr. Booth** : (*In reply to the Chairman*). I agree with Mr. Trench in this. I do not think that the Punjab Government having accepted these lower capacity factors for the Haveli and Thal, have any reason now to ask for a revision of them.
1061. **Rai Bahadur Jai Gopal** : (*In reply to the Chairman*). I have not studied these projects very well and I have no opinion to record.
1062. **Mr. Nicholson** : I think I might point out that in his statement Sir Bernard Darley made a remark regarding restriction of Bahawalpur in December, January and February. It has not been the desire to restrict Bahawalpur in these months to the same extent as Haveli.
1063. **Sir Bernard Darley** : I have got nothing further to say.
1064. **Chairman** : Do you agree that the opinion of the Committee as a whole is that this question regarding capacity factors should be decided by the Independent Members or not ?
1065. **Sir Bernard Darley** : I am quite satisfied to accept their decision now.
1066. **Mr. Nicholson** : I agree to accept for the Panjnad the same as the Thal.
1067. **Chairman** : You will not agree to the Independent Members deciding the capacity factors ?
1068. **Mr. Nicholson** : How can I ? The principle of the whole thing is equal treatment. In this connection I would refer to the Government of India letter No. 15-I of the 11th. January, 1921 ⁽⁷¹⁾.
1069. **Sir Bernard Darley** : I agree to leave the matter to the Independent Members.
1070. **Chairman** : All except Mr. Nicholson agree.
1071. **Mr. Nicholson** : I maintain the only thing is the principle.
1072. *The Committee then took paragraph 12 as re-written ⁽⁷²⁾ and various alterations were suggested.*
1073. **Mr. Nicholson** : With regard to this draft regarding paragraph 12, I would refer to the Interim report, paragraphs 20 and 21 in which the question was left to the Independent Members who advised against the adoption of the Punjab view. In paragraph 22, the question of the distribution of supplies in the Chenab between Haveli and Panjnad was left to the Independent Members with the concurrence of the representatives of Bahawalpur and the Punjab. The Independent Members gave their finding, and their finding in the draft Final Report on the matter is given in paragraphs 33 to 37 and it appears that the matter is not open to reconsideration in view of the fact that the matter was left to the Independent Members for their finding, which they have given.
1074. **Chairman** : We are perfectly justified in modifying the draft report in any way that the Committee suggests. We want a unanimous Report for the Government of India.

(71) Appendix XXIX.

(72) Proc. 1041

1075. **Sir Bernard Darley :** In my opinion, paragraph 22 of the Interim Report was drafted under a mis-apprehension. As I understood the position, what happened at Delhi was that Mr. Nicholson stated that he was not prepared to discuss the question of distribution, because there were numerous matters which he wished to look into in connection with the switching of water, and he also wished to look into and study the hydrographs once more, because the maximum capacities of both the Haveli and Panjnad canals had been altered. After some discussion, I stated that the quickest solution would be for Mr. Nicholson and me to try to come to a separate agreement, and if we could not do so, then we should refer the matter to the Independent Members. I regret very much that I did not notice sufficiently the wording of paragraph 22 when the Interim Report was sent to me, but I do think that Mr. Nicholson understood that we were to discuss this matter between ourselves, and if we could not come to an agreement, we should then refer the matter to the Independent Members.

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Now that the Independent Members have heard both sides of the question, I am perfectly prepared to leave the decision to them as regards the distribution between the Haveli and the Panjnad canals.

1076. *Sir Bernard Darley produced certain papers to substantiate his case.*
1077. **Mr. Nicholson :** *(to the Independent Members).* Is Sir Bernard Darley prepared to accept your finding ?
1078. **Sir Bernard Darley :** Yes.
1079. **Mr. Nicholson :** Then I have no doubt that on inspection of these documents here the Independent Members will be able to satisfy Sir Bernard Darley of the equity of their finding.
1080. **Chairman :** Which finding are you referring to, in the first draft report or the modified one ?
1081. **Mr. Nicholson :** Your findings in the first report. I will accept the modifications that you now put in in paragraphs 13 to 16. The only thing is the last sentence of paragraph 16. If that goes out, I am absolutely clear.
1082. *Paragraph 13.*

“ While agreeing to the principle of the Chenab supplies being confined to the Haveli project and the Bahawalpur canals at Panjnad, the Independent Members must point out that the problem is more complicated than that of the Indus by reason of the fact that during the major portion of the rabi season the Khanki, Rasul and Islam weirs are closed, and it is clear therefore, that during the major portion of the rabi period, the Haveli and Panjnad must be dependent on infiltration or regeneration below those weirs. From the records of discharges it is seen that it may not be possible at times to divide water strictly in proportion to the authorized capacities of the canals, because the regeneration between Trimmu (Haveli Project) and Panjnad may be more than the Panjnad Canal's share ”.

Paragraph 14.

“ Again there is no certainty as to what effect closing of the inundation canals between Trimmu and Panjnad and the substitution of weir controlled canals will have on the regeneration between these points.”

Paragraph 15.

“ In view of these difficulties the Independent Members recommend that the Haveli canals should be allowed to draw off all regeneration water above Trimmu up to its authorized capacity and the Panjnad canal would draw off any water arriving at Panjnad weir also up to its authorized capacity.”

Paragraph 16.

“ If, however, it becomes apparent that either of the Haveli or Panjnad canals is not receiving the same proportion of its authorized capacity as is the other, then the method of distribution must be revised and a water account maintained as on the Sutlej, water being shared according to the monthly authorized maxima.”

Paragraph 17.

"The Independent Members feel that in this case also it is necessary for the monthly mean withdrawals to be defined which has already been done in Table IV ⁽⁷³⁾ in the case of the Haveli and Thal projects."

1083. **Mr. Trench** : Mr. Nicholson, are you prepared to accept paragraph 12 ? ⁽⁷⁴⁾
1084. **Mr. Nicholson** : Paragraph 12 as it stands up to the word "maintained". But supposing this afternoon after you study this matter with Sir Bernard Darley you find that any amplification is necessary, I am quite prepared to consider it. But it is I think premature to commit ourselves at this present moment until the matter has been further studied.
1085. **Chairman** : We will take paragraph 12 later, tomorrow morning. We will now take up 13, 14, 15, 16 and 17. Any modifications ?
1086. **Sir Bernard Darley** : The only modification that I wish to propose in paragraph 16 is to add the words "as proposed by the Committee" after the words "authorized maxima".
1087. **Mr. Booth** : Till we know what the findings of the Committee are on paragraph 12 is it not premature to discuss this ?
1088. **Chairman** : 12 is practically finished except the portion about period.
Then paragraph 13 is accepted in full.
14 and 15—no changes.
16—subject to reconsideration after inspection of the hydrographs.
17 needs to be re-drafted now.
What about 18 ?

1089. *Paragraph 18.*

"Until such time as the Haveli project is constructed, then Panjnad should be allowed to withdraw its full requirements up to the specified monthly discharges, on the understanding that it is purely a temporary arrangement which must not give rise to the acquiring of rights in those waters. Table III ⁽⁷⁵⁾ below gives the Panjnad canal capacities, but it is essential for the monthly mean withdrawals to be included."

1090. *Paragraph 18 was accepted by the Committee after changing "acquiring of rights" into "acquisition of rights".*

1091. *Paragraph 19.*

"The Committee agree that since in their opinion the Bahawalpur canals at Panjnad should be severed from the Sutlej, a change in the distribution of water on the Gharra reach of the Sutlej was necessary in view of the reduced area in the Bahawalpur State to be served by the Gharra reach, and they have agreed to a re-distribution of the supplies between the Punjab, Bahawalpur and Bikaner. Original allocation of shares in supplies available was made upon agreed figures of gross area. Culturable irrigable areas were not known, and even now the new proposals are not prepared on a common basis, and in fact it appears to be quite impossible to make a distribution strictly on a logical basis accounting for culturable irrigable area, full supply factors, duties and intensities, modified in turn by climatic conditions, rainfall and considerations of water-table."

Paragraph 20.

"The Committee, however, agreed to the distribution of the supplies in the Gharra reach of the Sutlej in accordance with Table V below" ⁽⁷⁶⁾.

1092. **Rai Bahadur Jai Gopal** : I suggest that in Table V ⁽⁷⁷⁾ in columns 3, 5 and 7 the heading might be changed to "percentage share of total supplies utilized in canals".
1093. *It was agreed to make this entry as a footnote.*
1094. *Paragraphs 19 and 20 were then accepted.*

⁽⁷³⁾ Appendix XXVI.

⁽⁷⁴⁾ Proc. 1041.

⁽⁷⁵⁾ Appendix XXIV.

⁽⁷⁶⁾ Appendix XXVII.

⁽⁷⁷⁾ Appendix XXVII.

1095.

Paragraph 22.

Proc. 952-5.

"The Committee are of the opinion that on the evidence recorded in the Proceedings a case exists for revising the official dates of the beginning and end of the kharif period for the non-perennial canals, and their proposals are as follows :—

- (a) On the Indus below Mithankot, Sind will retain the existing practice *i.e.*, the kharif period will be from the 1st. of April to the 30th. of September.
- (b) On the Indus above Mithankot and on the Panjnad and Haveli canals the kharif period shall be from the 15th. of April to the 15th. of October, but should water be available after the demands of the perennial canals have been met the non-perennial canals may remain open to the 31st. of October. If, however, supplies are surplus at Sukkur a non-perennial canal may open after the 1st. of April.
- (c) In the Gharra reach of the Sutlej. In early kharif the perennial canals of the three partners shall have preference to the extent of 26% of their revised capacities, *i.e.*—

						Cusecs.	26% Cusecs.
Punjab	..	..	..	..	..	3,940	1,024
Bahawalpur	..	..	..	..	..	6,340	1,648
Bikaner	..	..	..	..	..	2,720	707
						13,000	3,379

1096. *Sir Bernard Darley suggested 1,025 cusecs as the Punjab share, so that the total would be exactly 26% of 13,000.*

1097. *Mr. Nicholson stated that the note that he and Sir Bernard Darley had signed had been altered and that item (2) had been entirely omitted.*

1098. *It was agreed that the paragraph should be re-drafted.*

1099.

Paragraph 23.

"Until the river rises to give this discharge of 3,379 cusecs at canal heads, the rabi percentages shall apply. When the discharge available is above this, the excess shall be allotted to non-perennial canals in the following proportion :—

Punjab	..	..	..	..	..	72%
Bahawalpur	..	..	..	..	..	28%

until the non-perennial canals draw 26% of 15,990 *i.e.*, 4,157 cusecs."

1100. *Sir Bernard Darley: In paragraph 23 of the new draft, for the word 'draw' I would like the words 'are allotted' to be inserted. The reason for this is that at present on account of the shortage of water during the early kharif season we have set aside certain non-perennial areas and informed the people that they cannot expect water early in the season, and therefore the full 26% may not be passed into the non-perennial canals. If you say 'draw' it might sometimes lead to a quibble later.*

1101. *Rai Bahadur Jai Gopal suggested that the original should not be altered.*

1102. *Sir Bernard Darley: Will the Committee agree to this being put in as a foot-note?*

1103. *Mr. Nicholson: Could not the other paragraph cover it? It does cover it so far as I can see.*

1104. *Sir Bernard Darley: Is there any objection to a foot-note to make the matter clear?*

1105. *Mr. Trench: I would say; "until 26% equal to 4,157 cusecs are being utilized".*

1106. *Mr. Nicholson: Why not say: "that is to say, that the changes in sharing occur at the supplies in the river given above".*

1107. **Mr. Trench** : I would suggest :

“ This is subject to the freedom of distribution given in paragraph 36 ”, or,

“ Whether this discharge has been utilized on non-perennial canals or elsewhere as proposed in paragraph 36 ”.

1108. *The latter alternative was accepted.*

1109. **Rai Bahadur Jai Gopal**.—I want to make the following additions as suggested by Mr. Foy :—

“ Each partner shall have full right to use its percentage share of the net supplies available in Kharif or in Rabi in its perennial or its non-perennial canals. In practice the water distribution account for each crop is divided into 3 sub-periods which will be taken as units of time for the distribution of water under article 18 of the Sutlej Valley Project Agreement of 1920.”

1110. **Chairman** : He wants this note added, as a separate sentence, which, if it is accepted by the Committee, should come under 36. Is it accepted by everybody ? Then, it seems 36 will have to be re-drafted.

Paragraphs 24, 25, 28 and 29 accepted.

1111. *Paragraph 24.*

“ Above this combined discharge of $3379 + 4157 = 7536$ cusecs at canal heads the partners will share as follows :—

Punjab	..	..	..	..	..	..	53%
Bahawalpur	..	..	..	..	..	..	37%
Bikaner	..	..	..	..	..	..	10%

and these kharif percentages will apply, whatever the discharge, from July to 15th. October.”

Paragraph 25.

“ Bikaner canal discharge will be gauged immediately downstream of the unlined portion, i.e., at mile 6 approximately.”

Paragraph 28.

“ The Independent Members have found it impossible to frame any rules for the allocation of water between claimants, but they have accepted and have endeavoured to act according to the general direction of the Secretary of State that in allocating water, the greatest good to the greatest number, must be sought without reference to political boundaries.”

Paragraph 29.

“ It is clear, however, that the factors which decide claims to water and allocation of supplies, at a time when a project is prepared, may not necessarily be the deciding factors if the position is reviewed some years later, after the canals have been in operation for some time.”

1112. *Paragraph 30 was then discussed.*

Paragraph 30.

“ An *ad hoc* investigation into each case in which the conditions have changed is clearly necessary and, as the conditions under which the distribution of water was made originally, may in due course, no longer hold good, no factor should be allowed to interfere with a re-distribution which is of itself equitable, if that re-distribution can be shown to be in the general interests. The question of financial returns should be considered along with other aspects of the case.”

1113. *In the last line but one, the words “ financial returns ” were, at the suggestion of Mr. Nicholson, replaced by the words “ economic aspect ”, and the amended draft then accepted.*

1114. *At this stage Mr. Trench raised the question of the switching of supplies. It was decided to add a paragraph about switching at the end, somewhere between paragraphs 45 and 46.*

1115.

Paragraph 31.

"Generally speaking, the acquiring of rights in water in perpetuity should never be allowed. While not wishing to detract from the sanctity of agreements, the Independent Members are strongly of the opinion that it should be recognized generally that circumstances may arise which justify the reviewing of an agreement which is proved to be no longer equitable, and where on full enquiry, the Interested Parties being represented, this belief is indubitably proved, in modifying the agreement to accord with the altered conditions."

1116. *The following amendments were suggested.*

In line 1, for the word "never" the word "not" should be substituted.

In line 3, delete "strongly".

For the portion after "opinion that" in line 3, substitute the following:—

"Circumstances may arise justifying the reviewing of an agreement which is no longer equitable, and where on full enquiry, the interested parties being represented, this is found to be the case, the agreement should be modified to meet the altered conditions".

1117. *The amendments were accepted.*1118. *Paragraph 32.*

"The Independent Members are of the opinion that the fundamental basis for the distribution of water must be the culturable irrigable area as defined in definition No. 29 of Central Board of Irrigation Publication No. 5 "Glossary of Technical and Vernacular Terms in connection with Irrigation in India."

"To render this possible, the Independent Members hold that no project should be submitted for sanction in the future unless and until a detailed soil survey has been carried out by some accepted agency."

Paragraph 33.

"The Independent Members have been greatly impressed by the organization which has been maintained in the Punjab for many years and a similar organization has recently been introduced in Sind to watch the rise and fall of sub-soil water levels throughout those Provinces, and they are strongly of the opinion that in future no project should be submitted for sanction without full data relating to the prevailing sub-soil water conditions. No claim for water, particularly for perennial irrigation, should be entertained in respect of land which is liable to be waterlogged."

Paragraph 34.

"The factors affecting this question are several, such as :

1. prevailing depth of subsoil water,
2. nature of the soil to be irrigated,
3. facilities for drainage,
4. nature of soil through which canals are excavated and whether they are to be lined,
5. rainfall,

and whether wells are to be used in addition for irrigation. It is impossible to lay down any hard and fast rules relating to those factors, and every case must be considered on its merits."

These were accepted with slight modifications.

1119.

Paragraph 35.

"The consequences however are likely to be so serious that claimants should refrain from making any such demands in their own interests, but it is essential for the authority deputed to consider such claims to insist upon the most rigid investigation of those aspects of a project."

1120. *Mr. Trench suggested a modification of this as follows :—*

“ The consequences of water-logging, however, are likely to be so serious that, in the interests of the areas concerned, demands for perennial irrigation should not be made where there is danger of water-logging, and it is essential that all authorities considering future projects should insist on a rigid investigation of the sub-soil water conditions referred to in paragraph 34 above.”

This was accepted.

1121. *Paragraph 36.*

“ Subject to the remarks above, the Independent Members are of the opinion that once water has been allocated to a Province or State, the distribution thereof should be left to the discretion of that authority. No rabi water should be allocated to any non-perennial canal or non-perennial area, but subject to this restriction and those mentioned above, an authority may utilize the water allocated to its perennial area, in any area or through any channel, which it deems fit.”

1122. **Mr. Nicholson :** There is one point I would like to suggest. The transfer of supplies to other areas should not constitute a new claim for further supplies or water.

1123. *The Chairman suggested that paragraph 36 might be re-drafted and taken up the next day.*

1124. *Paragraph 37.*

“ The Independent Members feel obliged to record their opinion that the authorized withdrawals for Sind are very high, and they consider that the irrigation authorities in Sind are over optimistic in their view that water-logging in Sind is improbable. From the experience of other Provinces the independent Members believe that as time goes on the Sind engineers will find it advisable to tighten up the supplies and thereby be able to lessen their requirements at Sukkur.”

1125. *It was felt that the paragraph needed re-drafting and it was decided to re-consider it the next day.*

1126. *The Committee then discussed the question whether in making the recommendations the word “ Committee ” should be used instead of “ Independent Members ”, and it was held that wherever there was unanimity of opinion the word “ Committee ” should be used.*

Proceedings of the third day (June 19th. 1935).

1127. **Chairman :** The first business this morning is to bring up-to-date the proceedings of the 17th. and 18th. June.

1128. *This was done, and the Committee then continued discussion of the draft report.*

1129. *Mr. Trench proposed that the following revised draft be adopted in place of paragraphs 3 to 5.*

Paragraph 3.

“ The Committee are of opinion that the irrigation of Khairpur State should be brought on to a perennial basis.

They accept the figures of 6,40,000 acres as the culturable irrigable area of the State on the East and West Feeders ; this includes 40,000 acres of shikargah which the Committee are prepared to include in the area for which perennial water should be supplied.

The supply of water per thousand acres perennial cultivation on the British Canals taking off from Sukkur is 4.2 cusecs.

This is arrived at as follows :—

Culturable perennial area	..	..	..	..	5,49,700	acres.
Full supply Discharge, less non-perennial supplies for rice	..	..	..	..	22,900	cusecs.
Discharge per thousand acres	..	..	..	..	=4.2	cusecs.

With the same discharge per thousand acres the capacity of the Khairpur State East and West Feeders should be 2,688 cusecs.”

Paragraph 4.

"In Sind, however, the crop ratio aimed at on perennial canals is 2 rabi to 1 kharif and the intensity is 81% while in Khairpur the intensity of 80% is proposed to be attained with a crop ratio of 1.25 rabi to 1 kharif. The Committee agree that a greater capacity in the canals will be necessary to take the larger supplies required for kharif. In rabi the capacity factor of the canals will be proportionately decreased. The rabi withdrawals authorized will, therefore, be less than those which would have to be allowed on the same basis as on the Rohri Canal. The Committee therefore agree that the mean monthly withdrawals for each month should be as shown in Table I (attached)." ⁽⁷⁸⁾

Paragraph 5.

"In the case of the State area to be irrigated from the Eastern Nara Canal, for which a non-perennial capacity of 400 cusecs was previously allotted, the Committee agree to the allotment for the future of a perennial capacity of 267 cusecs. The authorized withdrawals of the Barrage Canals including Khairpur will now be as shown in Table II (attached)." ⁽⁷⁹⁾

Paragraph 6.

"No prescriptive right to any discharge in excess of the figures in column 2 of Table II can be claimed. Since, however, the authorized Khairpur withdrawals are mean monthly withdrawals, the condition under which extra water may be withdrawn as enunciated in Government of India letter No. I. R. 6 of 29th. June, 1929, is reaffirmed*. That is to say that if the Khairpur Canals wish to take a greater supply for part of the month they will be permitted to draw the excess, provided the water is available at Sukkur and the monthly mean is not exceeded."

1130. *After some discussion Mr. Trench suggested the addition of the following words after the word "decreased" in his revised draft :—*

"But in view of the special circumstances in Khairpur including the fact that two parallel canals have to be run, one on either side of the Rohri canal, leading to a diminution of efficiency, the Committee agree to accept the rabi duty proposed for Khairpur viz., 122 at canal head".

1131. *The Committee accepted the revised draft with this amendment.*

1132. *Paragraphs 4, 5 and 6 as redrafted were accepted, also Tables I and II ⁽⁸⁰⁾ with the footnote at the end of Table I omitted, being unnecessary.*

Paragraph 12.

1133. **Sir Bernard Darley:** The Independent Members and I studied in detail the hydrographs put up by Mr. Gunn yesterday afternoon. They undoubtedly put a different complexion on the situation and the only way in which a solution could be found which would suit all parties would be to omit any reference to mean monthly discharges for the Haveli and Panjnad canals. The conditions on these canals are most peculiar, since they must work entirely on regeneration during a great portion of the year. The supplies at times are short of requirements but as a rule whenever there are sufficient supplies there is at the same time ample water at Sukkur and therefore it was suggested that, as the mean monthly discharges are only put in in order to safeguard the interests of the Sukkur canals, the Bombay Government might agree to the decision already come to—that the Haveli and Panjnad canals would not share in any shortage in the Indus river. There is no necessity to limit their discharges in any month when the water happens to be available.

⁽⁷⁸⁾ Appendix XXII.

⁽⁷⁹⁾ Appendix XXIII.

* The relevant sentence is as follows :—

"I am directed to say that the Government of India have no objection to certain of the canals in the Sukkur Barrage project being designed to draw-off a larger volume of water than that allotted to them in the project estimate on the conditions proposed by the Government of Bombay, viz., that no prescriptive right to the additional quantity of water is claimed by the local Government and that the additional water will be utilized only when available, instead of letting it run waste."

⁽⁸⁰⁾ Appendices XXII and XXIII.

1134. **Mr. Trench :** I agree that in practice, whenever there is a shortage of supply at Sukkur, thus creating a theoretical demand on the Panjnad, before supplies above the authorized mean withdrawals of the Haveli and Panjnad canals can be utilized by them there will in fact be no such supplies available, and therefore the question of limiting the supplies of the Haveli and Panjnad to the monthly means which have been recorded in the tables would not arise.

1135. **Chairman :** In short, assistance cannot be obtained from the Panjnad.

Then we keep paragraph 12 ⁽⁸¹⁾ as redrafted yesterday down to the word "maintained" and cut out the next paragraph. The portion "For the period... canals" will stand. The Table as regards the full capacities agreed will also stand.

1136. *A discussion then arose as to the column regarding "Monthly mean withdrawals" in Table III ⁽⁸²⁾. A suggestion was made that the monthly mean withdrawals for both projects should be omitted in the final report although the column will be in the Proceedings for the purpose of reference by the Central Board of Irrigation.*

1137. *Mr. Trench was prepared to agree to the mean monthly withdrawals of the Thal in the rabi season, being increased to the same capacity factors as given in Table III (amended) ⁽⁸³⁾ for Panjnad provided there is water available at Sukkur.*

1138. *At this stage Mr. Nicholson prepared a statement Table (VI) ⁽⁸⁴⁾ of capacity factors for Sind, the Punjab (existing), Thal (according to Table IV) ⁽⁸⁵⁾ the Panjnad (according to amended Table III) ⁽⁸⁶⁾ and the Haveli. Sir Bernard Darley added revised figures (Col. 6) which he was prepared to accept for the Panjnad Canal.*

1139. **Mr. Trench :** In view of the situation in Sind I prefer to have the mean monthly withdrawals specified and am prepared to accept the second proposal (Col. 6 Table VI) for the Panjnad canals.

1140. **Chairman :** If you are escaping water at Sukkur, the Panjnad and Thal can take-off more than these capacity factors permit? You agree to the proposed capacity factors?

1141. **Mr. Trench :** Yes I agree.

1142. *Paragraph 16.*

"If, however, it becomes apparent that this method of distribution is unsatisfactory, the matter shall be referred to arbitration by either party; the method of arbitration shall be specified in the agreement, but under present conditions should be by means of an *ad hoc* Committee of the Central Board of Irrigation."

This re-draft was accepted with some slight changes.

Paragraph 17.

"The maximum monthly discharges given in Tables III (amended) ⁽⁸⁷⁾ and IV ⁽⁸⁸⁾ for the Panjnad, Haveli and Thal canals were accepted by the Committee, but in the event of supplies at Sukkur being in excess of the authorized withdrawals these three canals may share; the Thal should have prior claim up to the Panjnad capacity factors, thereafter any spare water should be shared by the three canals in proportion to their maximum authorized discharges for the season concerned.

1143. *This re-draft was accepted with the addition of the following footnote.*

N. B.—In the case of the Khairpur Canals, the term "authorized withdrawals" shall include any excess over the figures given in Column 8 of Table II ⁽⁸⁹⁾ required by Khairpur provided the monthly mean is not exceeded."

1144. *The following re-draft of paragraph 22 was considered and accepted.*

Proc. 953-5.

"The Committee are of the opinion that on the evidence recorded in the Proceedings a case exists for revising the official dates of the beginning and end of the kharif period for the non-perennial canals, and their proposals are as follows:—

(a) On the Indus below Mithankot, Sind will retain the existing practice as laid down in the Sukkur Barrage Project Report of 1919.

⁽⁸¹⁾ Proc. 1041.

⁽⁸²⁾ Appendix XXIV.

⁽⁸³⁾ Appendix XXV.

⁽⁸⁴⁾ Appendix XXVIII.

⁽⁸⁵⁾ Appendix XXVI.

⁽⁸⁶⁾ Appendix XXV.

⁽⁸⁷⁾ Appendix XXV.

⁽⁸⁸⁾ Appendix XXVI.

⁽⁸⁹⁾ Appendix XXIII.

(b) On the Indus above Mithankot and on the Panjnad and Haveli canals the kharif season shall be from the 15th. of April to the 15th. of October. but should water be available after the demands of the perennial canals have been met, the non-perennial canals may remain open to the 31st. of October. Provided that :—

(i) if supplies are surplus at Sukkur a non-perennial canal may open after the 1st. April,

(ii) should supplies from the western rivers be “switched” to the Sutlej, at some future date, no claim on such “switched” supplies shall be made on behalf of the non-perennial canals taking off at Trimmu (Haveli) and Panjnad.

If, however, supplies are surplus at Sukkur a non-perennial canal may open after the 1st. of April.

(c) In the Gharra reach of the Sutlej. In early kharif the perennial canals of the three partners shall have preference to the extent of 26% of their revised capacities, *i.e.*—

					Cusecs.	26% Cusecs.
Punjab	..	..	..	..	3,940	1,025
Bahawalpur	..	..	..	..	6,340	1,648
Bikaner	..	..	..	..	2,720	707
					<hr/> 13,000	<hr/> 3,380

1145.

Paragraph 23.

“Until the river rises to give this discharge of 3,379 cusecs at canal heads, the rabi percentages shall apply. When the discharge available is above this, the excess shall be allotted to non-perennial canals in the following proportion :—

Punjab	..	..	..	..	..	..	72 %
Bahawalpur	..	..	..	..	..	..	28 %

until the non-perennial canals draw 26% of 15,990, *i.e.*, 5,157 cusecs, whether this discharge is being utilized in the non-perennial canals or elsewhere as approved in paragraph 36”⁽⁹⁰⁾

1146. *Rai Bahadur Jai Gopal objected to the words “whether this discharge is being utilized in the non-perennial canals” to the end of the sentence, but after Mr. Trench and Sir Bernard Darley explained the matter, it was decided to adhere to the draft, which was accepted after changing 3,379 cusecs to 3,380.*

1147.

Paragraph 24.

“Above this combined discharge of 3,379+4,157 =7,536 cusecs at canal heads the partners will share as follows:—

Punjab	..	..	..	..	..	..	53 %
Bahawalpur	..	..	..	..	..	..	37 %
Bikaner	..	..	..	..	..	..	10 %

and these kharif percentages will apply, whatever the discharge, from July to 15th. October.”

This re-draft was accepted with slight changes in figures.

1148.

Paragraph 36.

“The Independent Members are of the opinion that once water has been allocated to a Province or State, the distribution thereof should be left to the discretion of that authority. No rabi water should be allocated to any non-perennial canal or non-perennial areas, but subject to this restriction and those mentioned above, an authority may utilize the water allocated to its perennial area, in any area or through any channel, which it deems fit.

Any such transfer of water should not, however, entitle the authority concerned to make new claims for further supplies of water.

Each partner to an agreement shall have full right to use its percentage share of the net supplies available in kharif or in rabi in its perennial or non-perennial canals. In practice the water distribution account for each crop is divided into three sub-periods which will be taken as units of time for the distribution of water under Article 18 of the Sutlej Valley Project Agreement 1920."

1149. *The following amendment suggested by Mr. Nicholson was accepted by the Committee.*

Delete from "In practice" and read as follows:—

"To apply Article 18 of the Sutlej Valley Project Agreement 1920, the water distribution account for each crop is divided into three sub-periods which are taken as units of time for the distribution of water. This practice is considered to be desirable and should not be changed."

1150. *Paragraph 44.*

"It was a matter of great satisfaction to the Independent Members to find that these records were accepted by every member of the Committee without hesitation. In this respect the Independent Members would like to quote the following resolution of the Committee:—

Proc. 963.

"One of the outstanding features of our proceedings has been the acceptance by every representative of the records of river discharges, placed at our disposal by Mr. Gunn (Executive Engineer, Discharge Division) who accompanied Mr. Nicholson. We are confident that, but for the information so obtained, it would have been impossible for this Committee to reach any conclusion as to the adequacy of the water supply at the key points on the Indus and its tributaries. We record our opinion that the work of the Discharge Division has been of the utmost value and importance.

Proc. 964.

We record our concurrence with the views of Sir Thomas Ward expressed in 1921, that each Province interested in water supplies should maintain some organization continuously, to keep records of this nature. As questions of water supplies become of greater importance with India's development, authentic records of this nature become more and more essential to the solution of these problems. We congratulate the Punjab Government on their enterprise in this respect and trust that the organization now in being will continue this most valuable—indeed we may say essential—work."

1151. *It was agreed to add the following at the end of the paragraph.*

"In Sind, similar records of discharges have been maintained since 1902."

1152. *Paragraph 45.*

"Storage works are an expensive expedient and small storages have not as a rule proved remunerative. The Independent Members consider, however, that the value of storage in regulating the flow of rivers, in reducing peak floods and economising in water, is so great, that they invite particular attention to the unanimous resolution of the Committee on this subject.

"This Committee is of opinion that small storage schemes of a capacity not exceeding half a million foot acres, on the affluents of the Indus and its five main tributaries for storage of water during the months of July and August may be undertaken by any Provincial or State Government, without the formal sanction of any other party.* But all other interested parties should be informed of the main details of the scheme prior to its being undertaken.

"Any scheme exceeding the above capacity must have the prior approval of all interested parties."

*The intention of this resolution is to restrict such storages to affluents of the Indus, and to affluents of the five main tributaries, viz., Jhelum, Chenab, Ravi, Beas and Sutlej.

1153. *This was re-drafted as follows and accepted.*

"Storage works are an expensive expedient, and small storages have not as a rule proved remunerative. The Committee consider storage schemes to be of great value in regulating the flow of rivers, in reducing peak floods, and in economizing in water, and are, therefore, of opinion, that small storage schemes of a capacity not exceeding half a million foot acres on the affluents of the Indus and its five main tributaries for the storage of water during the months of July and August may be undertaken by any Provincial or State Government without the formal sanction of any other authority.* But all other interested parties should be informed of the main details of the scheme prior to its being undertaken. The proposed Woolar Lake Scheme on the Jhelum, although on a main river, is of such a small capacity that it may be included with the above."

1154. *Paragraph 48.—Agreements. (No draft).*

After some discussion the Committee agreed to leave the question of agreements to the Independent Members, to make their recommendations.

Proceedings of the fourth day (June 20th. 1935).

1155. *The meeting commenced at 9 a.m.*

The Committee went through the proceedings of the previous day and made corrections where necessary.

Discussion of the Draft Report was then continued.

1156. *The following re-drafted paragraphs 3 to 10 were accepted with slight modifications.*

Paragraph 3.

"The Committee are of opinion that the irrigation of Khairpur State should be brought on to a perennial basis.

They accept the figure of 6,40,000 acres as the culturable irrigable area of the State on the East and West Feeders: this includes 40,000 acres of Shikargah which the Committee are prepared to include in the area for which perennial water should be supplied.

The supply of water per thousand acres perennial cultivation on the British Canals taking-off from Sukkur is 4.2 cusecs.

This is arrived at as follows:—

Culturable perennial area	5,49,700 acres.
Discharge, less non-perennial supplies for rice	22,900 cusecs.
Discharge per thousand acres	4.2 cusecs.

With the same discharge per thousand acres the capacity of the Khairpur State East and West Feeders would be 2,688 cusecs."

Paragraph 4.

"In Sind, however, the crop ratio aimed at on perennial canals is 2 rabi to 1 kharif and the intensity is 81 per cent. while in Khairpur State an intensity of 80 per cent. is proposed to be attained with a crop ratio of 1.25 rabi to 1 kharif. The Committee agree that a greater capacity in the canals will be necessary to take the larger supplies required for kharif. In rabi the capacity factor of the canals will be proportionately decreased but in view of the special circumstances in Khairpur State, including the fact that two parallel canals have to be run, one on either side of the Rohri Canal, leading to a diminution of efficiency, the Committee agree to accept the rabi duty of 122 at canal heads proposed for the State. They, therefore, agree that the mean monthly withdrawals for each month should be as shown in Table I." ⁽⁹¹⁾

Paragraph 5.

"In the case of the State's area to be irrigated from the Eastern Nara Canal, for which a non-perennial capacity of 400 cusecs was previously allotted, the Committee agree to the allotment for the future of a perennial capacity of 267 cusecs. The authorized withdrawals of the Barrage canals including Khairpur will now be as shown in Table II." ⁽⁹²⁾

* The intention of this resolution is to restrict such storages to affluents of the Indus, and to affluents of the five main tributaries, viz., Jhelum, Chenab, Ravi, Beas and Sutlej.

⁽⁹¹⁾ Appendix XXII.

⁽⁹²⁾ Appendix XXIII.

Paragraph 6.

"No rights to any discharge in excess of the figures in column 9 of Table II can be claimed. Since, however, the authorized Khairpur withdrawals are mean monthly withdrawals, the condition under which extra water may be withdrawn, as enunciated in Government of India letter No. I.R.-6 of 29th. June, 1929, is reaffirmed.* That is to say if the Khairpur Canals require a greater supply for part of the month they will be permitted to draw the excess, provided the water is available at Sukkur and the monthly mean is not exceeded."

Paragraph 7.

Proc. 923 Appendix XVI of Volume II. Para. 17 of Interim Report. "The Committee agree to an increase of 6,500 cusecs maximum withdrawal for British Sind Canals in the month of October to meet the deficit caused by failure to include in the sanctioned Project the requirements for kharif crops in that month on the Eastern Nara, North Western and Dadu canals. This 6,500 cusecs is included in the figures in Table II." (93)

Paragraph 8.

"The Committee agree to a capacity for the Thal Project canals of 6,000 cusecs with a rabi capacity factor of 0.6 and a mean rabi supply of 3,600 cusecs."

Paragraph 9.

Proc. 240. "The newly proposed Paharpur canal requires for the irrigation of the North-West Frontier and the Punjab tracts a maximum supply in kharif of 875 cusecs with a mean discharge of 500 cusecs, and a maximum rabi supply of 700 cusecs with a mean of 360 cusecs, to which the Committee agree."

Paragraph 10.

Proc. 915. "In the event of the supply in the Indus proper being insufficient the Thal and Paharpur canals will share supplies available during any period of shortage with the Sukkur Barrage canals on the basis of their authorized maximum withdrawals for the period concerned. The Committee consider that the Haveli and Panjnad canals should have a prior claim on the waters of the Panjnad up to their authorized withdrawals. In the event of any shortage at Sukkur the Haveli and Panjnad canals would not be called upon to forego their right to any water up to their authorized withdrawals."

Paragraph 12.

157. "The Committee recommend that the supplies in the Chenab at Trimmu and Panjnad be shared between the Haveli Project when it is constructed, and the Bahawalpur canals taking-off at Panjnad; the latter will have no claim whatsoever on Sutlej Waters, except for regeneration below Islam weir, which will be included in the available supplies at Panjnad. When the shares of the two canal systems cannot be met the available water should be apportioned, if physically possible, on a basis of their capacities or authorized full supply discharges.

For the period 16th. to 31st. October after the demands of the perennial canals have been met, the non-perennial canals should share the balance of water according to the full capacities of those canals.

The full capacities agreed to are :—

—	Perennial.	Per cent.	Non-perennial.	Per cent.	Total.	Per cent.
Haveli	2,750	65	5,000	44	7,750	48
Panjnad	1,500	35	6,500	56	8,000	52

*The relevant sentence is as follows :—

"I am directed to say that the Government of India have no objection to certain of the canals in the Sukkur Barrage project being designed to draw-off a larger volume of water than that allotted to them in the project estimate on the conditions proposed by the Government of Bombay, viz, that no prescriptive right to the additional quantity of water is claimed by the local Government and that the additional water will be utilized only when available, instead of letting it run waste."

(93) Appendix XXIII.

1158. *Mr. Trench suggested the following modification in the first three lines of paragraph 12, which was accepted:—*

“When the Haveli Project is constructed, the supplies of the Chenab at Trimmu and Panjnad will be shared between the Haveli, and Bahawalpur canals taking off at Panjnad.”

1159.

Paragraph 13.

“While agreeing to the principles of the Chenab supplies being confined to the Haveli project and the Bahawalpur canals at Panjnad, the Committee consider that the problem is more complicated than that of the Indus, by reason of the fact that during the major portion of the rabi season the Khanki, Rasul and Islam weirs are closed, and it is clear, therefore, that during the major portion of the rabi period the Haveli and Panjnad must be dependent on infiltration or regeneration below those weirs. From the records of discharges it is seen that it may not be possible at times to divide water strictly in proportion to the authorized capacities of the canals, because the regeneration between Trimmu (Haveli Project) and Panjnad may be more than the Panjnad canal's share.”

Paragraph 14.

“Again there is no certainty as to what effect closing of the inundation canals between Trimmu and Panjnad and the substitution of weir controlled canals will have on the regeneration between these points.”

Paragraph 15.

“In view of these difficulties the Haveli canals should be allowed to draw-off all regeneration water above Trimmu up to its authorized withdrawals and the Panjnad canal would draw off any water arriving at Panjnad weir, also up to its authorized withdrawals.”

Paragraph 16.

“If, however, it becomes apparent that this method of distribution is unsatisfactory, the matter shall be referred to arbitration by either party; the method of arbitration shall be specified in the agreement, but under present conditions should be by means of an *ad hoc* Committee of the Central Board of Irrigation.”

These were accepted with slight changes.

1160.

Paragraph 17.

“The maximum monthly discharges given in Tables III (amended) ⁽⁹⁴⁾ and IV ⁽⁹⁵⁾ for the Panjnad, Haveli and Thal canals were accepted by the Committee but in the event of supplies at Sukkur being in excess of the authorized withdrawals these three canals may share; the Thal should have prior claim up to the Panjnad capacity factors. Thereafter any spare water should be shared by the three canals in proportion to their maximum authorized discharges for the season concerned.

N. B.—In the case of the Khairpur Canals, the term “authorized withdrawals” shall include any excess over the figures given in Column 8 of Table II ⁽⁹⁶⁾ received by Khairpur provided the monthly mean is not exceeded.”

1161. *The following amendment was agreed to:—*

“The mean and maximum monthly discharges given in Tables III (amended) and IV for the Panjnad, Haveli and Thal canals were accepted by the Committee, but in the event of supplies at Sukkur being in excess of the authorized withdrawals, Thal may claim additional withdrawals up to the Panjnad capacity factors. Thereafter any spare water should be shared by the three systems in proportion to their maximum authorized discharges for the periods concerned.”

N. B.—In the case of the Khairpur Canals the term “authorized withdrawals” shall include any excess over the figures given in Column 8 of Table II ⁽⁹⁶⁾ received by Khairpur provided the monthly mean is not exceeded.”

⁽⁹⁴⁾ Appendix XXV.

⁽⁹⁵⁾ Appendix XXVI

⁽⁹⁶⁾ Appendix XXIII

1162.

Paragraph 36.

"The Committee are of the opinion that once water has been allocated to a Province or State, the distribution thereof should be left to the discretion of that authority. Each partner to an agreement shall have full right to use its allotted share of the net supplies available in kharif or in rabi, in its perennial or non-perennial canals. No rabi water should be allocated to any non-perennial canal or non-perennial area, but subject to this restriction and those mentioned above, an authority may utilize the water allocated to its perennial area, in any area or through any channel, which it deems fit.

Any such transfer of water should not however, entitle the authority concerned to make new claims for further supplies of water.

To apply Article 18 of the Sutlej Valley Project Agreement of 1920, the water distribution account for each crop is divided into three sub-periods which are taken as units of time for the distribution of water. This practice is considered desirable and should not be changed."

This was accepted.

1163.

Paragraph 37.

"The Independent Members feel obliged to record their opinion that the authorized withdrawals for Sind are high, and they consider that the careful investigations into the possibilities of water-logging now being carried out should be continued. From the experience of other Provinces the Independent Members believe that as time goes on the Sind engineers will find it advisable to tighten up the supplies and thereby lessen their requirements at Sukkur."

This recommendation of the Independent Members, with the substitution of "Sukkur Barrage canals" for "Sind" was not objected to.

1164.

Paragraph 49.

"It appears clear to the Committee that the Indus basin is not the only case in which difficulties are likely to arise, in connection with the distribution of water, and they are of the opinion that it is highly desirable that there should be some central co-ordination of Provincial and Indian State activities in connection with the gauging and recording of water flow in rivers affecting several units."

Paragraph 50.

"The compilation and study of the voluminous records involved should generally be the duty of a full time officer and staff in each province concerned, and all the work should be supervised and controlled by some central authority."

These paragraphs were accepted.

1165.

Paragraph 51.

"The Independent Members would like to draw attention to the proceedings of the Committee on this aspect (Proc. 798-835) and it is suggested that the Government of India give the point their careful consideration in view of the approaching removal of irrigation from the list of reserved subjects."

1166. *Mr. Trench proposed the following re-draft:—*

"As this is one of the most important Committees of the Central Board of Irrigation that has been called on to advise the Government of India, the members feel that they would be evading their responsibilities if they did not call the attention of the Government of India to the fact that they consider that the presence of an irrigation adviser with the Government of India would have greatly expedited the disposal of this and similar cases."

1167.

After discussion it was decided to omit paragraph 51 and to refer the question to the Central Board of Irrigation with a request that the Government of India be approached to ask local Governments their opinion as to whether an Irrigation Adviser was necessary.

1168.

Chairman: The only point now left over, so far as I remember, is the question of switching water from one river to another.

1169.

Mr. Trench suggested a draft and then left the meeting to keep an appointment. Before leaving, he proposed that the proceedings and discussions should not be finally printed-up. It was, however, decided that the proceedings should be printed as a separate volume but marked confidential, if approved by the Government of India.

1170.

Further discussion on the switching of water and Mr. Trench's draft was postponed till 2 p. m. to which time the Committee adjourned.

1171. *The Committee met in the afternoon and proceeded to consider the question of Switching.*
1172. *Mr. Nicholson opened the discussion by referring to paragraphs 622—624 of the Proceedings and stressed the point that it was not proposed to switch any water at the end of the kharif, and the proposed switching at the beginning of that season might mean a delay in opening the Sind inundation canals by 5 or 6 days only.*
1173. *Mr. Trench held that 5 or 6 days were almost as important at the beginning as at the end of the season and he thought that in view of the attitude of Sind towards the rest of the proposals, it was rather unfair to expect them to accept such a proposal now, which was not likely to come into operation for 10 years.*
1174. *Mr. Nicholson stated that the point was raised in the Punjab BRIEF and he would like the Committee to come to some conclusion on the matter now if possible. The scheme had been prepared in rough, but no further action could be taken until and unless it was found that there was a chance of getting the water. The switching would only be done in April and May and in view of the enormous help it would afford to the Sutlej Valley Project canals he considered that the proposal should be agreed to as it could only have a very small effect on the Sind canals.*
1175. *Mr. Nicholson proposed a draft for acceptance by the Committee, to which Mr. Trench did not agree.*
1176. *The Chairman said he thought they might record a general statement but they could not be definite.*
1177. **Sir Bernard Darley:** This is not a very opportune moment. I think that this should be taken up later after careful investigation. I would say that the Committee has been forcibly convinced of the appalling shortage of water during early kharif—in the last few years it has sometimes been only 10 per cent. of the required supplies—the only way to remedy this is by switching water over from the Ravi or Chenab. The only effect of this switching would be to cause the inundation canals in Sind to be opened a week or so later. Considering the enormous advantage to the Sutlej Valley canals it certainly seems a question which should be gone into very thoroughly at an early date.
1178. **Chairman:** I think a general recommendation is indicated.
1179. **Mr. Betterton:** I agree.
1180. **Chairman:** Mr. Trench, would you accept a general recommendation as mentioned by Sir Bernard Darley?
1181. **Mr. Trench:** The only recommendation I would accept is that the possibilities of this might be investigated or something of that kind.
1182. **Chairman:** And considered by the Central Board of Irrigation.
1183. *The following draft was then read by the Secretary, and accepted by the Committee.*
"The Committee agree to the utilization of the water in the Ravi set free by the construction of the Haveli, wherever the Punjab so desire. They are also impressed by the insufficiency of the supplies on the Sutlej canals at the beginning of the kharif season when it is particularly required for higher valued crops and there would be no objection to the switching of supplies from the Chenab if it were not evident that such action would affect the inundation canals in Sind to the extent of delaying the opening of the canals by about a week. Although it would be of distinct advantage to the Sutlej Valley Project canals, the matter needs to be investigated thoroughly in regard to the possible effect on the Sind inundation canals."
1184. **Chairman:** Gentlemen, the only thing I have to mention now is that the work done this week has been most useful and it is very satisfactory that the decisions arrived at on all major ISSUES are unanimous.
 The next point is the Final Report. The draft will be undertaken and we hope a copy will be sent to each member by the middle of July. The complete report should reach the Government of India by the beginning of September at the latest and every member is asked to return his copy of the Final Report within a week of its receipt.
1185. *After some discussion it was decided that the Findings of the Committee should be sent to each member who would be asked to say if there was anything in them, which was not correct, and also authorize the Secretary to print his signature at the end thereof.*
1186. *The Committee then adjourned sine die.*

PART VIII.

**APPENDICES TO PART VII
AND
PLATES RELATING THERETO.**

APPENDIX I. (A).

THE ORIGINAL ISSUES.

1. Should the non-perennial irrigated areas receive perennial water ?

2. The representatives of the different parties will please give the required information in the form attached.*

NOTE.—The representatives of the Interested Parties should be in a position to justify their project intensities as they will be examined on these.

(For definition of "intensity" please see item No. 39 of Central Board of Irrigation, Publication No. 5.)

3. *Duties*.—The representatives of the Interested Parties should be in a position to state their duties as these will be analysed in respect of quality of land, rainfall, method of cropping and sub-soil water-table.

(For definition of "duty", please see item No. 56 of Central Board of Irrigation, Publication No. 5.)

4. At this stage the members of the Committee will be called upon to express their views as to whether the available discharges should be divided on a basis of gross area or culturable irrigable area.

5. What are the available river supplies at all the strategic points on the Indus and its tributaries between October and June ?

Regeneration will be examined at this stage.

6. The available supplies in early kharif are generally inadequate for perennial and non-perennial canals. The Committee will therefore consider the advisability of fixing the percentage of withdrawals of each party for perennial and non-perennial canals or for both.

7. The Committee will discuss the question of inundation canals at this stage in respect of the minimum levels required.

8. With reference to the Haveli project, what are the maximum and mean supplies required in (a) kharif and (b) rabi, and are these supplies available without affecting the efficiency of the existing canal system ?

9. With reference to the Thal project what are the maximum and mean supplies required in (a) kharif and (b) rabi, and are these supplies available without affecting the efficiency of the existing canal systems ?

10. The Committee may be asked to express their view as to the advisability of an independent water control officer.

F. ANDERSON,

Chairman.

* Not printed.

APPENDIX I. (B).

THE FINAL FORM OF THE ISSUES.

1. *A principle*.—Should non-perennial irrigated areas receive perennial water ?

2. *Project areas*.—The representatives of the Interested Parties will please give the required information in the form attached.*

NOTE.—The representatives of the Interested Parties should be in a position to justify their project intensities as they will be examined on these.

(For definition of “intensity” please see item No. 39 of Central Board of Irrigation, Publication No. 5.)

3. *Duties*.—The representatives of the Interested Parties should be in a position to state their duties as these will be analysed in respect of quality of land, rainfall, method of cropping and sub-soil water-table.

(For definition of “duty”, please see item No. 56 of Central Board of Irrigation, Publication No. 5.)

4. *A principle*.—At this stage the members of the Committee will be called upon to express their views as to whether the available discharges should be divided on a basis of gross area or culturable irrigable area.

5. *Records*.—What are the available river supplies at all the strategic points on the Indus and its tributaries between September and June ?

The Committee will also discuss the question of inundation canals in respect of the minimum levels required.

Regeneration also will be examined at this stage.

6. *A principle*.—Should existing canals take precedence over future projects in considering the division of surplus water found available ?

7. *Records*.—The available river supplies for certain existing canals, both perennial and non-perennial, are said to be inadequate at certain seasons. The Committee will examine this question together with that of the dates of opening and closing of non-perennial channels.

8. With reference to the Haveli project, what are maximum and mean supplies required in (a) kharif and (b) rabi, and are these supplies available without affecting the efficiency of the existing canal systems ?

9. With reference to the Thal project, what are the maximum and mean supplies required in (a) kharif and (b) rabi, and are these supplies available without affecting the efficiency of the existing canal systems ?

10. *Control*.—The Committee may be asked to express their view as to the advisability of an independent “water control officer”.

F. ANDERSON,

Chairman.

* Not printed.

		Minim dis	Data for 1932-33.									
River.	Ever record ed.	Distributary discharge.				Capacity factors.		Delta.		Duty Rabi.		
		Autho- rized.	Mean.		Kharif.	Rabi.	Kharif.	Rabi.	F. S. F. Kharif.			
			Kharif.	Rabi.								
1	2	15	16	17	18	19	20	21	22	23		
		Cusecs	Cusecs.	Cusecs.	Cusecs.			Ft.	Ft.	Acres.	Acres.	
Sutlej	..	2,81	4,598	2,845	2,643	0.62	0.58	1.9	1.5	118	237	
			372	173	33	0.47	0.09	2.9	0.5	60	680	
			4,970	3,018	2,676	0.61	0.54	2.0	1.5	114	243	
			4,489	3,405	1,657	0.76	0.37	2.6	1.1	107	329	
Ravi	..	1,27	1,071	773	131	0.72	0.12	3.3	0.8	79	454	
			5,560	4,178	1,788	0.75	0.32	2.7	1.1	101	339	
			2,100	678	311	0.32	0.15	2.5	1.0	47	372	
			210	65	16	0.31	0.08	4.6	0.5	25	455	
			190	50	14	0.26	0.07	2.3	0.6	41	576	
			105	32	8	0.31	0.08	3.0	0.5	38	690	
			2,605	825	349	0.32	0.13	2.6	0.9	45	391	
			4,489	3,405	1,657	0.76	0.37	2.6	1.1	107	329	
			3,676	1,598	480	0.43	0.13	2.9	0.9	55	408	
			8,165	5,003	2,137	0.61	0.26	2.7	1.0	83	347	
			1,677	1,128	665	0.67	0.40	3.5	1.6	70	232	
			4,00	616	303	30	0.49	0.05	5.5	0.6	33	595
			2,293	1,431	695	0.62	0.30	3.8	1.5	60	248	
			3,338	2,353	2,168	0.70	0.65	2.6	1.6	97	230	
			1,852	1,190	891	0.64	0.48	3.3	1.8	70	197	
			3,578	3,327	1,709	185	0.51	0.06	3.5	1.1	54	344
5,179	2,899	1,076	0.56	0.21	3.4	1.6	60	222				
Jhelum and Chenab.	}		8,312	6,835	5,146	0.82	0.62	2.8	1.5	108	249	
			991	504	73	0.51	0.07	3.9	2.1	48	177	
			9,303	7,339	5,219	0.79	0.56	2.8	1.5	102	248	
			5,566	4,757	3,227	0.86	0.58	3.5	2.0	90	181	
			401	316	24	0.79	0.06	4.9	4.6	58	80	
			5,967	5,073	3,251	0.85	0.55	3.5	2.0	88	180	
			20,745	16,263	12,097	0.78	0.58	3.0	1.6	95	222	
			5,335	2,832	312	0.53	0.06	3.9	1.2	50	299	
			26,080	19,095	12,409	0.73	0.48	3.1	1.6	86	225	

Data for 1932-33.

Data for 1932-33.											
River.	Kharif Rabi ratio.	Distributary discharge.			Capacity factors.		Delta.		F. S. F. Kharif.	Duty Rabi.	Remarks.
		Autho- rized.	Mean.		Kharif.	Rabi.	Kharif.	Rabi.			
			Kharif.	Rabi.							
1	14	15	16	17	18	19	20	21	22	23	24
		Cusecs.	Cusecs.	Cusecs.			Ft.	Ft.	Acres.	Acres.	
	1 : 1.41	2,658	1,467	1,268	0.55	0.48	3.9	2.3	52	153	
	1 : 0.99	2,055	962	153	0.47	0.07	5.2	0.8	33	437	
	: 1.27	4,713	2,429	1,421	0.52	0.30	4.3	1.9	44	183	
	: 1.46	5,926	2,231	284	0.38	0.05	5.8	0.5	24	726	
	: 2.75	2,534	907	134	0.36	0.05	9.8	0.5	13	689	
	: 1.28	4,582	1,591	225	0.35	0.05	5.4	0.6	23	605	
	: 1.94	4,393	2,078	2,246	0.47	0.51	5.4	3.0	32	123	
	: 2.07	2,831	1,017	231	0.36	0.08	8.7	0.9	15	383	
	: 2.20	1,446	475	451	0.33	0.31	7.3	3.1	17	117	
	: 1.09	2,210	886	255	0.40	0.12	4.4	1.2	33	313	
	: 1.37	3,656	1,361	706	0.37	0.20	5.1	1.9	27	188	
	: 1.62	532	210	42	0.39	0.08	5.6	0.7	26	528	
	: 1.96	1,949	1,020	824	0.52	0.42	3.5	0.5	55	253	
	: 1.78	10,446	5,040	4,789	0.48	0.46	4.5	2.4	39	152	
	: 1.44	20,670	7,804	1,324	0.38	0.06	6.0	0.7	23	523	
	1.60	31,116	12,844	6,113	0.41	0.20	5.3	1.6	29	233	
	2.12	120	57	12	0.48	0.10	7.1	0.7	24	510	
	1.29	5,223	4,186	533	0.80	0.10	8.9	0.9	33	417	
	1.31	5,343	4,243	545	0.79	0.10	8.9	0.9	33	419	

Chenab
&
Sutlej.

Sutlej (Gharra)

Data for
1931-32.

Data for
1931-32.

H. W. NICHOLSON.

APPENDIX III.

Copy of confidential letter No. 15, dated the 6th. September 1906, from His Highness Mir Sir Faiz Mohammed Khan, Talpur, G.C.I.E., Ruler of Khairpur State, to the address of the Political Agent, Khairpur State.

"After compliments. With reference to your confidential letter No. K/24, dated the 21st. July last on the subject of the construction of a weir at Rohri on the River Indus, I have the pleasure to reply as under:—

Within the last 12 years of my rule, I have spent eleven lakhs of rupees on the improvement of the irrigational arrangements of my State, the result of which has been that in the first nine years, the revenue of my State rose by 100 p. c. and during the last three years it rose by another 80 p. c. Cultivation has spread so much that I could not find last year an area of 2,000 acres of commanded land (even in four blocks) for Camel Service Grants, so I have to deforest two reserved jungles and a shikargah. The area of actual cultivation is 32 p. c. on cultivable area in my State, whereas it is 21.6 in the Hyderabad District, including the Fuleli tract.

2. The condition of my canals is all that I can desire. My subjects and myself are quite satisfied and content. My canals and their feeders are so well constructed that in most part of inundation season the Head Regulators are kept partly closed; and even when the River is not high, the full supply is secured by opening wholly their Head Regulators. Within the last seven years (after the improvements have been carried out) deficiency of water supply has not been experienced, though there have been periods of low River and complaints of scarcity of water have been loud elsewhere.

3. I need hardly add that I enjoy complete freedom of increasing the supply in my State by digging new Canals or new Feeders, diverting water from one system to another, as occasion requires. The level of the country is fortunately favourable. In the greater portion of the length, the lands of the irrigated portion of my territories have had to be protected by large Bunds as the inundation level is above the general level of the country.

4. About $\frac{3}{4}$ of the Canal irrigated area depends⁽¹⁾ on Sathiwah and Mirwah, which join together lower down, the former being a feeder. The Heads of both are only three miles below Rohri and the spot is permanently reliable. In the last fifty years, since the Sathiwah was dug, the River has remained constant and unchanged there and is likely to remain so, as long as the state of things at Bukkur remains as now. The "Kharif" supply available at the heads of these canals is simply abundant, and as regards "Rabi" the Sathiwah brings in the Mirwah a perennial supply.

5. The remaining portion of the State is watered by comparatively smaller canals, one of which is a fairly large one. The Mainwah, Bodli Wah and Ahmedpur Wah irrigate mostly low tracts of rice fields, so that no more water is wanted there, and no change is required. The rest of the area mainly depends on the Abulwah (including Jadi and Madhowah), the upper portion of which is mostly "Moki" (flow) already and the lower portion which comprises mostly Jagirs is lift but is well served even in "Rabi" by innumerable wells. The water of the Mirwah can easily be taken there if found necessary.

6. For these reasons, the weir can not give more water than I have now in the "Kharif" season. On the contrary, it may restrict my present unlimited freedom of irrigation, and limit my supply to a Feeder Canal the water level of which, will not be perfectly better than that I have now got. While as regards "Rabi", the advantage to me is not, I beg leave to say, as large as you have pointed out. Out of the four talukas, in two (Mirwah and Faizganj) there is fairly satisfactory "Rabi" supply and I can, by small outlay improve the "Rabi" supply to nearly as good as I can get with the weir. For other reasons too, I have to carry out these improvements, whether the weir is constructed or not. In the remaining two talukas,⁽²⁾ (viz., Khairpur and Gambat) in the greater portion there are innumerable wells which have been constructed by large outlay. The rabi crops from wells are generally better paying than "moki-rabi" crops, while the cost of the wheels is in reality imperceptible, because the

(1) Page 20, Dr. Summers' Report on the Preliminary Estimates of the Rohri-Dad Feeder and Rohri-Hyderabad Canals:—

"The Mirwah and its second mouth, the Sathiwah, which has worked well and supplies about half of the Kharif and nearly the whole of the Rabi (supply) and now flows when the Bukkur Gauge reads zero, so that the Mirwah is practically a perennial Canal."

(2) Page 21 of Dr. Summers' Report on the Preliminary Estimates of Rohri-Dad Feeder and Rohri-Hyderabad Canals:—

"Plan No. 3 shows that the northern portion of the State and the Gambat taluka are liberally provided with wells, the number in some parts being as many as ten to twenty, and even thirty in one place to the square mile."

bullocks which are required to be maintained for kharif cultivation are used in "rabi" to lift water, instead of being kept idle. Moreover the well water is used to supplement Canal irrigation as in the months of August and September, the lands are well flooded and the seed is sown on saturation so derived, the well water being used later. Accordingly much large area is brought under "Rabi" than would be the case on purely well irrigation. The selling rate of wheat cultivated on wells is better than other wheat and the out-turn, as stated is larger per acre. The land holders in my state are peasants, proprietors possessing small area for which they have provided wells, so they do not quite stand in need of "rabi" flow water, that would be brought with the aid of the weir and are better off with inundation within "Sailab" aided by wells as now.

7. I am therefore not willing, nor desirous to see that the weir may be constructed at Rohri. I can say definitely that I do not want the weir, and much less I would undertake to pay anything towards its cost.

8. I can well understand, however, that it is not in my power to prevent the supreme Government from constructing the weir in their own limits at Rohri for the benefits of their territories. If they decide to construct it, I shall suffer very seriously. The heads of all my present canals being so near Rohri lower down, the supply in my canals in winter and June and July when water is specially wanted to start cultivation, and in September when it is more urgently needed for the crops to ripen, will fall down as the weir will be in use in those months, and the permanent loss to me and my subjects will be indescribably great. My canals will be rendered I may say, practically useless.

9. The course that will be left to me, will be to ask for justice to me and to my subjects and to request for a proper and sufficiently compensating water supply being restored at the entire cost of the British Government. I shall indeed ask that I should be given a separate Feeder from above the Weir at the cost of British Government to join the Sathiwah and the next to join the Mirwah at Khairpur, and that a branch from it should run on from near my boundary to feed the upper portion of the Mirwah, Bagharwah, Mainwah, Bodli, Ahmedpurwah, Abulwah, and branches, and Jadi and Madhow. This Khairpur Feeder will have to be left completely in my control from its head, and I should have jurisdiction over its length in British Limits, and the size of Head Regulator and the width of the land acquired should be large enough for widening the Feeder for future extension of cultivation, etc.

All the cost of this will of course be borne by British Government, as also of the bridges, regulators, re-alignments, diversions and every kind of other work which will be necessitated by the altered arrangements, within my limits or in British limits. The supply from the Branch of the Feeder to the Ulra Jagir and the Kingri tract will be given from one separate outlet only, for each, to avoid constant trouble.

10. I can not overlook that when I would ask for the restoration of my water supply I shall be required to allow the Feeder for the British Districts lower to pass through my State. Though very reluctantly it will be, I shall no doubt in those altered circumstances feel obliged to allow the Feeder to pass through my State after the weir is constructed; in which case I would ask that it should run alongside the Railway and should be provided to my satisfaction, with all the necessary bridges for communication, syphons for the branch of my feeder referred to, for any other canals or distributaries that will be cut and that wire fencing should be provided and all water courses, etc., that may be interfered with, will be made up for. I am informed that the area of land required will be under 2,400 acres and the width of the canal is 480 feet. I would ask that equitable compensation should be paid to my subjects while as regards my royalty claims, I will consider it derogatory to my prestige to ask for cash compensation and I shall have to leave it to the justice of the British Government.

11. I shall further ask that I should be allowed to make distributaries in the Nara taluka from the Nara Channel to irrigate and cultivate an area of about 120,000 acres which is lying waste there. The Nara Channel runs through my territory. I had unfettered rights to use the water. But when the exchange of lands took place by which a triangular piece at the head of the Jamrao was given up by me and the Keties to which I had independent claims were restored to me under restricted conditions, I was asked to include a condition in the Agreement, which runs as below :—

"His Highness the Mir agrees that he will not construct any new canal out of the Eastern Nara River or obstruct its water or divert it without the consent of the British Government."

I felt all along that my right to use water really wanted for irrigating my lands from the Nara Channel was not intended to be stopped, and that it was not meant that I should allow such a considerable area of land to lie waste, for which there was no other source of irrigation. I had reason to suppose that it was meant to keep a sort of supervision that the use I would make of the water was really needed for cultivation and was not a wasteful or speculative one. But from some recent indications I find that it is now intended that I should not dig any new canal from the Nara. This does not seem to be fair to me or to my subjects. The area is about

20,000 acres and the annual cultivation is not likely to exceed 10,000 acres at the most. The population is very scarce so the measures in view will be gradual. It seems probable that the intended restriction is due to anxiety for the Jamrao canal and the Nara valley system. But comparing the extent of the culturable area in my territory (20,000 acres) to the area commanded by the Jamrao Canal which is 900,000 acres, it would be felt that the apprehension is far fetched. In any case I think that when the Eastern Nara supplies water for about 500,000 of acres of annual cultivation in the Jamrao and Thar and Parker districts, some ten thousand acres of cultivation in my limits should not be minded and the condition of the agreement should not be so unfairly interpreted as to prevent me from getting the land cultivated.

12. Some provision will have to be made for the contingencies of failure of the weir after its construction or of the Feeder Canal.

In conclusion I may add that I shall have no objection to the detailed survey being made provided no trees are cut in my limits. After this is done I shall be willing to discuss and settle all the required details as generally specified above and I trust the details will be settled satisfactorily and after I am satisfied from the final project that the fair and proper needs of my State are met, I shall enter into an agreement on the lines sketched above.

Trusting you are in the enjoyment of excellent health."

Handed in on 4th. March 1935.

J. M. SLADEN.

APPENDIX IV.

Area statistics submitted by the Interested Parties in connection with ISSUE No. 2.

- A. *Sind.*—Statement showing culturable irrigable areas and areas proposed to be irrigated on the Lloyd Barrage British Canal Systems.
- B. *Punjab.*—Statement showing irrigation data for Haveli and Patti (Thal Canal) Projects.
- C. *N.-W. F. P.*—Statement showing the remodelling and extension of the Paharpur Scheme.
- D. *Bahawalpur.*—Statement showing the adjustments proposed on the Bahawalpur system of canals.
- E. *Bikaner.*—Statement showing enhanced irrigable areas.
- F. *Khairpur.*—Statement showing perennial areas.

APPENDIX IV. (A).

Sind.—Statement showing culturable irrigable areas and areas proposed to be irrigated on the Lloyd Barrage British Canal Systems.

(Lakhs of acres.)

Canal.						North Western.	Dadu.	Rice	Eastern Nara.	Rohri.
Headworks						Sukkur.	Sukkur.	Sukkur.	Sukkur.	Sukkur.
Gross Area						10·22	6·58	5·44	21·65	27·20
Culturable Irriga- ble area.	{	Perennial				7·06	4·29	Nil	18·99	24·63
		Non-perennial				1·90	·55	Rice 3·95 Dry .60 4·55	1·92	0·10
Percentage to be Irrigated.	{	Perennial Canals.	{ Kharif (Dry) ..			24	20	..	29	27
			{ Rabi			63*	60*	..	48	55
		Non-perennial (Rice). .. .			90	95	88	75	100	
Area proposed to be irrigated.	{	Kharif	{ Perennial			1·72	0·84	..	5·69	6·65
			{ Non-perennial ..			1·04	·52	4·02	1·43	·10
		Rabi (excluding dubari)			4·45	2·57	..	9·10	13·55	

* Due to mixed rice and dry distributaries.

W. L. C. TRENCH.

APPENDIX IV. (B).

Punjab.—Statement showing irrigation data for Haveli and Patti (Thal Canal) Projects.

Particulars.				Haveli Project.			Patti (Thal) Project. Perennial.
				Perennial.	Non-perennial.	Total.	
Headworks	..	..	..			Trimmu.	Kalabagh.
Gross Area	..	..	(Acres)	695,500	861,100	1,556,600	1,500,000
Culturable commanded area	..	..	..	608,075	705,576	1,313,651	1,275,000
Percentage of C. C. A. on Gross	..	..	..	87.5	82.0	..	85
Percentage of area to be irrigated.	On Gross area	Kharif	..	23.1	33.85	..	23.3
		Rabi	..	60.0	33.85	..	42.0
		Total	..	83.1	67.7	..	65.3
	On C. C. A.	Kharif	..	26.4	41.35	..	27.5
		Rabi	..	68.6	41.35	..	49.4
		Total	..	95.0	82.7	..	76.9
Area proposed to be irrigated.		Kharif	.. Acres	160,440	291,690	..	350,000
		Rabi	..	417,200	291,690	..	630,000
		Total	..	577,640	583,380	..	980,000

Haveli Project.

Gross area derived from 1" maps in statement accompanying the Punjab BRIEF (Annexure A, columns 10 and 11).

C. C. A. from Haveli Project 1932 statement page x, column 4.

Perennial Kharif area proposed to be irrigated got from canal head discharge of 2,750 cusecs giving a distributary head capacity of 2,292 cusecs multiplied by 70 acres per cusec capacity.

Perennial Rabi area proposed to be irrigated got from 1,788 cusecs mean supply for 6 months at canal head giving 1,490 cusecs at distributary head multiplied by 280 acres per cusec of mean supply.

(NOTE.—Mean withdrawal from 16th. October to 31st. March asked for is 1,700 cusecs.)

Non-perennial Kharif area proposed to be irrigated got from 5,000 cusecs canal head capacity giving 4,167 at distributary head multiplied by 70 acres per cusec capacity.

Non-perennial Rabi area proposed to be irrigated is equal to Kharif.

Percentage of area to be irrigated is worked out by dividing the irrigated area by Gross area and C. C. A. respectively.

Patti Project (Thal Canal).

C. C. A. assumed 85% of Gross area within irrigation limits.

Perennial Kharif area proposed to be irrigated is calculated at 6,000 cusecs at canal head giving 5,000 cusecs at distributary head multiplied by 70 acres per cusec capacity at distributary head.

Perennial Rabi area proposed to be irrigated is calculated from a capacity factor of 0.6 giving a mean Rabi discharge of 3,600 cusecs at Canal head which is equivalent to 3,000 cusecs at distributary head multiplied by a duty of 210 acres per cusec mean discharge at distributary head.

Percentage of area to be irrigated is worked out by dividing the irrigated area by Gross area and C. C. A. respectively.

APPENDIX IV. (C).

N.-W. F. P.—Statement showing the remodelling and extension of the Paharpur Scheme.

Canal.					Paharpur.		
					Original Proposal.		Alternative proposal.
					Perennial.	Non-perennial.	
Name of Headworks					Chashma.		
Gross Area Commanded					198,000	30,000	228,000
Culturable Irriga- able area.	Perennial				167,500	..	193,000
	Non-perennial .. .. .				..	25,500	..
Percentage to be irri- gated.	Perennial	Kharif	on C. I. A. C. 30 } 75%	25.5 } 63.75%	30 } 75% of C.I.A.C. 63.75% of Gross.		
		Rabi	45 }	38.25 }	45 }		
	Non-perennial .. .. .				..	65% C. I. A. C. 55.25% Gross	..
Area proposed to be irrigated in :—	Kharif	Perennial	50,200	..	56,800		
		Non-perennial .. .. .	..	9,900	..		
	Rabi		75,300	6,600	85,200		

Original proposal.

C. I. A. C. assumed at 85% of Gross within irrigation limits.

Kharif non-perennial = 39% } = 65% C. I. A. C. = { 33.15% } = 55.25% of Gross.
 Rabi „ „ = 26% } { 22.10% }

F. S. F. at outlet head, perennial kharif = 85 acres per cusec } + 20% absorption.
 F. S. F. at outlet head, non-perennial kharif = 75 acres per cusec }

F. S. F. at outlet head, perennial rabi = 180 acres per cusec Do.

Full supply, kharif = 875 cusecs.

Full supply, rabi = 500 cusecs.

Mean discharge kharif = 700 cusecs.

Mean discharge rabi = 360 cusecs.

Duty, kharif = $\frac{60,100}{700}$ = 85.86 acres per cusec at canal head = 100 at outlet head.Duty, rabi = $\frac{75,300}{30}$ = 210 acres per cusec at canal head = 251 at outlet head.*Alternative proposal.*

C. I. A. C. assumed 85% of gross area within irrigation limits.

F. S. F. at outlet head, kharif = 77.5 acres per cusec } + 20% absorption to canal head.
 F. S. F. at outlet head, rabi = 205.0 acres per cusec }

Full supply, kharif = 875 cusecs.

Full supply, rabi = 500 cusecs.

Mean discharge, kharif = 700 cusecs.

Mean discharge, rabi = 360 cusecs.

Duty, kharif = $\frac{56,800}{700}$ = 81.14 say 81.00 acres per cusec at canal head = 95.0 at outlet head.Duty, rabi = $\frac{85,200}{360}$ = 236.7 say 237 acres per cusec at canal head = 284.0 at outlet head.

APPENDIX IV. (D).

Bahawalpur.—Statement showing the adjustments proposed on the Bahawalpur system of canals.

Canal.	As proposed in revised project estimate 1926.					As now proposed.						Remarks.	
	Gross com- manded area in revised project.	Per cent. gross area to be irri- gated.	Area to be irrigated.			Commanded area.		Per cent. of cul- turable area to be irrigated.	Area to be irrigated.				
			Kharif.	Rabi.	Total.	Gross.	Culturable.		Kharif.	Rabi.	Total.		
Acres.	%	Acres.	Acres.	Acres.	Acres.	Acres.	%	Acres.	Acres.	Acres.			
			One to one and a half.			Perennial canals.			One to one and a half.				
Sadiqia ..	10,78,640	60	2,58,874	3,88,310	6,47,184	11,24,088	8,40,474	80	2,68,952	4,03,427	66,72,379	} Figures now pro- posed in the S. V. P. Com- mittee Report, Bahawal- pur, 1932.	
Bahawal ..	6,17,367	62	1,53,107	2,29,660	3,82,767	2,47,325	2,17,823	80	69,703	1,04,555	1,74,258		
Abbasia ..	2,70,000	55.7	60,156	90,234	1,50,390	..	..	..	..	..	..
Panjnad ..	..	..	..	..	..	4,19,032	2,75,790	80	88,253	1,32,379	2,20,632
Total ..	19,66,007	..	4,72,137	7,08,204	11,80,341	17,90,445	13,34,087	80	4,26,908	6,40,361	10,67,269		
			One to one.			Non-perennial canals.			One to one.				
Fordwah ..	4,50,934	60	1,35,280	1,35,280	2,70,560	4,47,086	4,24,731	60	1,27,419	1,27,419	2,54,838		
Bahawal and Qaimpur.	5,53,000	60	1,59,900	1,59,900	3,19,800	4,07,789	3,87,391	70	1,35,587	1,35,587	2,71,174		
Eastern ..	92,700	60	27,810	27,810	55,620	72,653	67,004	50	16,251	16,251	32,502		
Panjnad ..	14,55,500	70	5,09,425	5,09,425	10,18,850	9,95,268	8,66,272	70	3,03,195	3,03,195	6,06,390		
Abbasia ..	..	..	..	..	..	20,725	18,989	70	6,641	6,641	13,282
Total ..	25,52,134	..	8,32,415	8,32,415	16,64,830	19,43,521	17,64,387	..	5,89,093	5,89,093	11,78,186		

B. DARLEY.

APPENDIX IV. (E).

Bikaner.—Statement showing enhanced irrigable areas.

Canal.								Bikaner or Gang.
Name of Headworks								Ferozepur.
Gross Area (1)								758,506 (1)
Culturable irrigable area.	{	Perennial (2)						650,000 (2)
		Non-perennial						Nil.
Percentage to be irrigated.	{	Perennial.	{	Kharif				25 24 (3)
				Rabi				37.5 48 (3)
		Non-perennial						Nil.
		Area proposed to be irrigated in :-	{	Kharif	{	Perennial .. .. .				135,000 (4) 156,000 (5)
Non-perennial						Nil.		
Rabi						302,500 (4) 312,000 (5)		

NOTES :—

- (1) In addition to this gross area of 758,506 acres, which is the amount included in existing chaks, there is an area of 200,000 acres within the zone of economic command.
- (2) This is the area given in the Bikaner BRIEF and based on the figures of 1933-34. Since then a careful investigation and re-check of the chak areas shows that the culturable irrigable area for which channels have been built is 664,354 acres. The difference is small and is due to the increased command as channels consolidate. In addition there is an area of 94,589 acres of culturable irrigable area within the zone of economic command.
- (3) These percentages are the agreement percentages based on gross areas. In the Bikaner BRIEF para. 45, it has been shown that the supplies available in the Ghurra are sufficient to yield an intensity of 79% for all partners on the true culturable irrigable areas there assumed at 2,350,000 acres given reasonable irrigating efficiency. As long as the same intensity is adopted for all 3 parties, the actual intensity used is immaterial in Rabi, though in Kharif it affects the distribution between the perennial and non-perennial canals. In the Bikaner BRIEF para. 23, it has been suggested that intensities of 48% Rabi and 24% Kharif will most suitably meet the case.
- (4) 1920 Project figures.
- (5) As now proposed.

T. A. W. FOY.

APPENDIX IV. (F).

Khairpur.—Statement showing perennial areas.

Canal.					East Feeder.	West Feeder.	Total.
Name of Headworks					Lloyd Barrage (Sukkur).		
Gross Area					4,70,000	2,73,000 (1) 21,000	7,64,000
Culturable irrigable area.	{	Perennial			3,20,000	2,60,000 (1) 20,000	6,00,000
		Non-perennial .. .. .			..	..	..
Percentage to be irrigated.	{	Perennial	Kharif		27	27	..
			Rabi		54	54	..
	{	Non-perennial .. .. .			..	..	..
Area proposed to be irrigated in :—	{	Kharif	Perennial		86,400	70,200 (1) 5,400 (2) 40,000	2,02,000
			Non-perennial .. .. .		..	..	..
	{	Rabi			1,72,800	1,40,400 (1) 10,800 (2) 40,000	3,64,000

(1) British enclaves within the State viz. Phulwahan and Kingri-Manghanwari. Regarding British Ulra area it was decided in the Conference held at Sukkur on 15th. December 1933 under the Chairmanship of the Commissioner in Sind that it should receive water from the river as usual.

(2) For water supply to shikargahs in both the seasons.

J. M. SLADEN.

APPENDIX V.

Statement showing the 12 years (1922-33) average supply of the Punjab Rivers above the Upper Canal Headworks for ten-daily periods.

Month.	Ten daily periods.	River Supply in Cusecs.						
		Sutlej at Ruar above.	Sutlej at Ferozepur above.	Ravi at Madhopur above.	Chenab at Marala above.	Jhelum at Mangla above.	Beas at Mandi Plain.	Indus at Kala bagh.
1	2	3	4	5	6	7	8	9
January	1—10	4,409	5,427	1,993	6,490	7,585	4,696	28,139
	11—20	4,518	6,295	2,522	7,593	8,146	4,886	27,648
	21—31	4,417	5,929	2,768	8,248	10,048	5,039	27,012
February	1—10	4,866	6,104	3,565	9,402	11,310	5,901	29,523
	11—20	4,672	6,261	3,613	10,728	13,646	5,874	30,797
	21—28	4,768	6,206	3,937	10,584	15,102	5,635	30,229
March	1—10	4,628	6,253	4,882	12,399	20,986	6,118	37,281
	11—20	4,639	6,460	5,880	14,887	25,612	6,317	39,943
	21—31	5,199	6,629	6,672	15,949	29,610	6,918	48,428
April	1—10	5,606	6,684	7,391	17,828	35,009	6,811	62,601
	11—20	6,186	7,341	7,954	18,395	41,961	7,499	70,806
	21—30	8,277	9,044	8,826	21,120	48,307	8,334	82,581
May	1—10	10,683	10,157	9,579	24,448	55,227	8,807	95,987
	11—20	12,402	12,848	9,185	26,352	55,822	9,207	119,044
	21—31	17,062	14,692	10,817	31,585	62,847	9,549	155,597
June	1—10	23,439	21,709	11,738	40,219	65,533	12,061	197,597
	11—20	29,836	30,883	12,404	50,257	68,571	12,878	240,523
	21—30	42,412	45,936	15,240	63,132	70,403	18,840	274,362
July	1—10	49,439	64,871	18,372	73,983	69,511	24,229	277,922
	11—20	57,676	85,228	21,407	85,616	67,759	40,458	317,356
	21—31	66,268	114,339	25,221	93,529	64,000	49,996	335,981
August	1—10	64,052	126,619	23,825	91,131	57,866	53,289	303,484
	11—20	66,159	138,036	23,058	81,401	51,870	71,396	282,604
	21—31	54,325	119,949	20,869	77,651	52,078	56,838	273,214
September	1—10	38,807	80,738	15,101	61,503	43,228	41,573	185,859
	11—20	27,737	57,536	9,760	40,136	31,163	31,701	130,910
	21—30	18,546	33,790	6,426	23,552	22,052	19,345	85,837
October	1—10	13,650	25,612	5,059	16,860	16,902	15,896	64,670
	11—20	9,449	13,391	3,908	13,139	14,147	10,864	53,507
	21—31	7,874	9,344	3,204	10,213	11,977	8,482	47,418
November	1—10	6,867	7,519	2,795	8,575	10,230	6,638	40,317
	11—20	6,082	6,555	2,477	7,420	8,944	5,707	34,966
	21—30	5,504	5,910	2,161	6,894	7,676	5,289	32,048
December	1—10	5,343	5,864	2,154	7,205	7,503	5,112	30,857
	11—20	4,991	5,818	2,397	7,106	7,578	5,249	30,401
	21—31	4,794	5,403	2,085	6,567	7,122	5,046	27,960

APPENDIX VI. (A).

Statement giving mean and maximum monthly discharges required in the Lloyd Barrage British Canals (as authorized).

Months.	North Western Canal.		Rice Canal.		Dadu Canal.		Rohri Canal.		Eastern Nara.	
	Max.	Mean.	Max.	Mean.	Max.	Mean.	Max.	Mean.	Max.	Mean.
January	3,639	3,639	..	..	2,525	2,525	9,900	9,900	6,692	6,692
February	3,639	3,639	..	..	2,525	2,525	9,900	9,900	6,692	6,692
March	3,618	3,618	..	..	2,321	2,321	10,760	10,760	6,755	6,755
April	3,380	3,380	3,773	3,773	2,056	2,056	9,820	9,820	8,000	8,000
May	3,952	3,952	9,312	9,312	2,494	2,494	10,100	10,100	10,683	10,683
June	4,313	4,313	12,346	12,346	2,787	2,787	10,250	10,250	12,200	12,200
July	4,313	4,313	12,346	12,346	2,787	2,787	10,250	10,250	12,200	12,200
August	4,313	4,313	12,346	12,346	2,787	2,787	10,250	10,250	12,200	12,200
September	4,313	4,313	12,346	12,346	2,787	2,787	10,250	10,250	12,200	12,200
October	3,532	3,532	..	..	2,273	2,273	10,480	10,480	6,612	6,612
November	3,275	3,275	..	..	2,273	2,273	8,880	8,880	6,112	6,112
December	3,639	3,639	..	..	2,525	2,525	9,900	9,900	6,692	6,692

W. L. C. TRENCH.

APPENDIX VI. (B).

Statement giving mean and maximum monthly discharges required in the Lloyd Barrage British Canals (as per revised requirements).

Months.	North-Western Canal.		Rice Canal.		Dadu Canal.		Rohri Canal.		Eastern Nara.	
	Max.	Mean.	Max.	Mean.	Max.	Mean.	Max.	Mean.	Max.	Mean.
January	3,150	3,150	..	..	2,250	2,250	9,705	9,705	8,164	8,164
February	3,150	3,150	..	..	2,250	2,250	9,705	9,705	8,164	8,164
March'	3,150	3,150	..	..	2,250	2,250	9,600	9,600	8,164	8,164
April	2,000	1,750	3,400	3,400	1,500	1,300	9,565	9,565	10,611	10,611
May	4,000	3,500	10,215	8,933	2,500	2,350	9,660	9,660	12,349	12,349
June	5,300	5,300	10,215	10,215	3,100	3,100	9,730	9,730	13,389	13,389
July	5,300	5,300	10,215	10,215	3,100	3,100	9,730	9,730	13,389	13,389
August	5,300	5,300	10,215	10,215	3,100	3,100	9,730	9,730	13,389	13,389
September	5,300	5,300	7,000	7,000	3,100	3,100	9,730	9,730	13,389	13,389
October	4,700	4,450	..	..	3,100	3,100	10,270	10,270	11,700	11,700
November	3,150	3,150	..	..	2,190	2,190	9,705	9,705	7,351	7,351
December	3,150	3,150	..	..	2,250	2,250	9,705	9,705	8,076	8,076

W. L. C. TRENCH.

APPENDIX VII.

Comparison of the various demands for water : existing canals : present and proposed.

Canal.	C. C. A. where known.	Rabi Mean Supply.	Rabi Supply 0/00 acres.	Kharif Capa- city.	Kharif Mean Supply.	Kharif Supply 0/00 acres.
<i>S. V. P., Sutlej.</i>						
Existing—						
(1) Bikaner	650,000	1,072	1.65	2,144	1,310	2.02
(2) Punjab P.	800,000	1,720	2.15	3,440	2,104	2.63
(3) Bahawalpur	900,000	3,708	4.12	7,416	4,525	5.03
Proposed—						
(1) Bikaner	650,000	1,783	2.74	2,675	1,933	2.97
(2) Punjab P.	800,000	2,198	2.74	3,295	2,347	2.93
(3) Bahawalpur	900,000	2,468	2.74	3,703	2,624	2.92
<i>S. V. P., Panjnad.</i>						
Bahawalpur Existing ..	G270,000	516	1.91G	1,032	819	3.03G
Bahawalpur Proposed ..	275,790	1,032	3.74	1,857	1,409	5.11
Haveli Punjab	G695,500	1,798	2.59G	2,750	2,113	3.04G
Khairpur Existing	600,000	1,500	2.50	4,000	2,914	4.86
Khairpur Proposed	600,000	2,506	4.18	4,500	3,457	5.76
<i>Sukkur, British Canals—</i>						
Sanctioned—						
Rabi	5,935,844	22,481	3.78	41,896	38,551	6.03
Kharif	6,390,961					
Proposed—						
Rabi	5,935,844	24,157	4.07	41,734	..	..
Kharif	6,390,961					
Adopting Punjab Capacity Factors..	..	..	..	..	31,891	4.93

NOTE.—(1) Gross areas only available for Haveli and Panjnad Existing : all relevant figures based on these.

(2) In calculating mean kharif supply utilized, the capacity factors assumed for the S. V. P., Sutlej Series as in para. 37 of Bikaner BRIEF for existing, and as in para. 44 for the proposed. For the other canals where early kharif supplies are unrestricted as for the mean of the Punjab Canals *vide* para. 36 of Bikaner BRIEF.

T. A. W. FOY.

APPENDIX VIII.

DEFINITIONS in respect to areas employed by the Interested Parties in their Briefs indicating the basis of allocation of water.

A.—SIND.

Gross Irrigable Area.—The gross area less such area within the irrigation limit as may be excluded from irrigation by the project system or channel for any such reasons as high spring level or unsuitability of soil for canal irrigation.

Culturable Irrigable Area.—The gross area irrigable by lift or flow less the area not available for cultivation e.g. village areas, roads, unculturable lands.

NOTE.—Large areas of unirrigable lands are excluded from the gross irrigable area. Small isolated patches are excluded under the heading culturable irrigable area as unculturable lands.

W. L. C. TRENCH.

B.—PUNJAB.

SUTLEJ VALLEY PROJECT.

Gross Commanded Area.—In the case of the Sutlej Valley Project this is the total area within the irrigation limits. For the canals as constructed the limit of irrigation along the river is however somewhat different to that on which the areas were determined for the purposes of the 1920 Agreement.

Culturable Commanded Area.—In the case of this project the culturable area commanded has been determined from actual rectangulation and level surveys. Any area which is irrigated by lift, although not commanded by flow, is included as culturable commanded area.

COLONY CANALS.

Gross Commanded Area.—In the case of the colony canals the gross commanded area shown in the published statistics is the summation of the areas of all the villages and colony in chaks in which irrigation takes place. There are a certain number of other villages and chaks of crown waste in which no irrigation has so far taken place. These areas are not included. The total of such areas is not however so great as to materially affect the total area.

Culturable Commanded Area.—The culturable commanded area on the colony canals however is the total allotted area in which irrigation has taken place. Culturable commanded area which has not been so far allotted is not included under this head. As in the case of the Sutlej Valley Project, land actually uncommanded by flow but which is irrigated by lift is included in the culturable commanded area. It is on the culturable commanded area as recorded above that the water allowance for irrigation purposes is determined. In some cases of old villages on the Lower Chenab Canal an arbitrary culturable commanded area has been shown which has no connection with the actual, due to the fact that the supplies previously granted were not fully utilized.

SIRHIND CANAL.

Gross Commanded Area.—In the case of Sirhind Canal it is the summation of the areas of villages in which irrigation takes place. The villagers concentrate their irrigation in a portion of the village, as the effect of irrigation on the land renders it less suitable for barani crops.

Culturable Commanded Area.—The culturable commanded area on the Sirhind Canal is the summation of the areas of the fields in each village which actually come under irrigation. This concentration of irrigation in a portion of the village leads to greater efficiency as the watercourses are shorter and do not extend over the whole village. The result however is that considerable areas which are culturable and potentially commanded are not included.

1.

H. W. NICHOLSON.

C.—BAHAWALPUR.

Gross Commanded Area.—That portion of the gross irrigable area which is commanded by flow irrigation.

Culturable Commanded Area.—That portion of the culturable irrigable area which is commanded by flow irrigation.

B. DARLEY.

D.—BIKANER.

Gross Area.—On the Bikaner Canal the gross area includes all land within the irrigation boundaries of distributaries. Large blocks of land between distributary irrigation boundaries to which it is not proposed to give irrigation at present are not included in the gross area.

Culturable Commanded Area.—The culturable commanded area is the gross area within irrigation boundaries of distributaries less all land not easily commanded by flow, less unculturable land excluded by reason of the fact that it is occupied by village sites, roads, railways, canals and sandhills.

T. A. W. FOY.

APPENDIX IX.

Statement showing number of days in the months of January to April and September to December since the year 1929 on which the discharges in the Indus at Sukkur (including the old Head Eastern Nara up to March 1933 when it was finally closed) fell short of (a) present authorized discharge ; (b) new British and Khairpur State canals requirements.

Year.			1929.	1930.	1931.	1932.	1933.	1934.	Average of last 5 years.
January	No. of days.	a	..	..	..	2	..	..	..
		b	..	..	..	4	7	..	2
February	No. of days.	a	..	..	..	3	17	..	4
		b	..	..	..	6	25	3	7
March	No. of days.	a	..	..	..	..	17	9	5
		b	..	..	..	3	19	17	8
April	No. of days.	a	..	..	..	..	..	17	3
		b	..	..	..	..	..	16	3
September	No. of days.	a	..	..	..	..	..	..	..
		b	..	..	..	..	..	..	..
October	No. of days.	a	..	..	..	..	..	..	..
		b	..	..	..	..	..	..	..
November	No. of days.	a	..	..	..	..	..	..	..
		b	..	..	..	..	..	..	..
December	No. of days.	a	..	..	..	5	..	..	1
		b	..	..	..	9	..	..	2

W. L. C. TRENCH.

APPENDIX X. (A).

Letter No. 8255 I. W., dated 3rd. June, 1929, from Government of Bombay to Government of India.

No. 8255-I.W.

PUBLIC WORKS DEPARTMENT.

Bombay Castle, 3rd. June 1929.

FROM

C. M. LANE, ESQUIRE,

Joint Secretary to the Government of Bombay,

Public Works Department.

TO

THE CONSULTING ENGINEER TO THE GOVERNMENT OF INDIA,

Department of Industries and Labour,

Public Works Branch.

SUBJECT :—Alterations in the alignment of the Lloyd Barrage Canals.

SIR,

I am directed by the Governor in Council to refer to paragraph 2 of your letter No. I-6/109, dated 5th. November 1927, and to enclose herewith a statement showing, month by month, the discharges allotted to each of the Lloyd Barrage canals as per actual detailed designs, the total of such discharges being compared with the volume shown in paragraph 15 of the Government of India, Despatch No. 23-P.W., dated 16th. December 1920.

2. The Government of India will observe that the demands, month by month, exceed the project figures to the extent shown below (*vide* column 10 of the statement):—

					Project.	As per actual detailed designs.	Difference.	Percentage.
					Cusecs.	Cusecs.	Cusecs.	
January	..	..	..	..	22,756	23,802	1,046	4.6%
February	..	..	..	..	22,756	23,802	1,046	4.6%
March	.	..	..	..	23,454	25,339	1,885	8.0%
April	..	..	..	..	29,029	30,871	1,842	6.3%
May	..	..	..	..	39,543	40,041	498	1.3%
October	..	..	..	..	25,897	27,121	1,224	4.7%
November	..	..	..	..	23,540	24,604	1,064	4.5%
December	..	..	..	..	25,756	26,714	958	3.7%

3. I am now to make the following observations in regard to these excesses :—

- (i) The figures of discharges given in paragraph 15 of the Government of India Despatch No. 23-P.W., dated 16th. December 1920, are a copy of those given in the last column of statement No. 1 following paragraph 24 of Volume V of the Sukkur Barrage Canals Project (1919-20). From an examination of that statement it has been found that there is an arithmetical error in totalling up the discharges for the months of January, February and December. The totals should have been 22,756, 22,756 and 25,756 cusecs, instead of 22,656, 22,656 and 25,656 cusecs, respectively. The figures in the statement accompanying this letter have now been compared with the project figures thus corrected.
- (ii) In my predecessor's letter No. 8255-I.W., dated 12th. September 1927, it has already been brought to the notice of the Government of India that the excesses shown in paragraph 2 *supra* are largely due to the lack of exact data in consequence of which

APPENDIX X. (A). *contd.*

the transit losses in the Eastern Nara were originally under-estimated. The project allowed for a uniform transit loss of 832 cusecs (about $8\frac{2}{3}$ cusecs per million s. ft. of wetted surface) in every month of the year ; but when preparing working designs the whole question of transit losses in this channel was exhaustively reviewed and it was decided to adopt for purposes of transit losses 8 cusecs per million s. ft. of wetted perimeter. Had it not been for this factor of increased transit loss, the difference between the project and the revised discharges would have been insignificant, *vide* columns 10 and 13 of the appended statement.

4. In paragraph 2 of their letter under reply, the Government of India say that they are not in a position to agree to the allotment to the Lloyd Barrage and Canals Project of any supplies in excess of those mentioned in paragraph 15 of their Despatch No. 23-P.W., dated 16th. December 1920 ; and that if any modifications of the project necessitate an increase of supply to certain of the canals, the additional volume must be met in full by the omission of, or the reduction of the supply to, other portions of the system.

I am to say that the Government of Bombay do not wish to reduce in any way the area to be commanded as now worked out in detail for each channel, nor to tamper with the duties allowed for in the project. It would be inadvisable to curtail any area, for any such reduction would have to be carried out empirically, and in the end the auction sales of Government lands might be adversely affected. The Government of Bombay consider it equally inadvisable to increase the duties, which have been arrived at after very careful investigation not only by officers on special duty but also by conferences representing the Irrigation, Revenue and Agricultural Departments. The question then arises whether the procedure of designing the Eastern Nara to draw-off a larger volume of water than the volume allotted to it in the project estimate can be admitted. The Governor in Council understands* that there will be no objection to this

**Vide* paragraph 18 of the Report of the Indus Discharge Committee, 1929.

provided that no prescriptive right to the additional quantity of water shown in column 10 of the appended statement is claimed by the Government of Bombay and that this additional water will be utilised only when available, instead of letting it run waste to the sea, and this is what is intended. The Government of India will, it is presumed, agree to the small corrections mentioned in paragraph 3(i) above.

I have the honour to be,

SIR,

Your most obedient servant,

(Sd.) C. M. LANE,

Joint Secretary to the Government of Bombay

Public Works Department.

Accompaniment :—

The statement referred to. (*See next page.*)

APPENDIX X. (B).

Letter No. I.R.6, dated 29th. June, 1929, from the Government of India to Government of Bombay.

GOVERNMENT OF INDIA.

DEPARTMENT OF INDUSTRIES AND LABOUR.

PUBLIC WORKS BRANCH.

No. I.R.6.

Simla, the 29th. June, 1929.

FROM

A. BREBNER, Esquire, C.I.E.,

Offg. Consulting Engineer to the Government of India.

TO

THE SECRETARY TO THE GOVERNMENT OF BOMBAY,

Public Works Department.

SUBJECT :—*Alterations in the alignment of the Lloyd Barrage Canals.*

SIR,

With reference to the correspondence resting with your letter, No. 8255-I.W., dated the 3rd. June, 1929, I am directed to say that the Government of India have no objection to certain of the canals in the Sukkur Barrage Project being designed to draw-off a larger volume of water than that allotted to them in the project estimate, on the conditions proposed by the Government of Bombay, viz., that no prescriptive right to the additional quantity of water is claimed by the local Government and that the additional water will be utilized only when available, instead of letting it run waste.

2. As regards the arithmetical error of 100 cusecs in totalling up the discharges for the months of January, February and December, referred to in your letter, I am to say that the Government of India are not in a position to agree to the allotment to the Lloyd Barrage and Canals Project of any supplies in excess of those mentioned in paragraph 15 of their despatch No. 23-P.W., dated 16th. December 1920 with which the project was submitted to the Secretary of State for sanction. As the difference is small, indeed so small as to be almost insusceptible of measurement, the Government of India trust that the Government of Bombay will not press the matter.

I have the honour to be,

SIR,

Your most obedient servant,

(Sd.) A. BREBNER,

Offg. Consulting Engineer to the Government of India.

APPENDIX XI.

Statement showing discharges of Panjnad River during early and late kharif period during the past 4 years.

[To be substituted for Annexure G appended to the Bahawalpur BRIEF.]

Period.					1931.	1932.	1933.	1934.
April	1—10	..	..	..	16,208	12,551	15,084	3,340
„	11—20	..	..	..	22,976	14,393	19,422	5,611
„	21—30	..	..	..	31,460	19,156	25,541	13,915
May	1—10	..	..	..	34,097	19,075	25,398	19,238
„	11—20	..	..	..	44,552	18,702	37,377	14,570
„	21—31	..	..	..	41,863	21,727	40,476	12,047
June	1—10	..	..	..	41,408	35,067	59,436	24,134
Sept.	21—30	..	..	..	51,665	23,448	109,440	24,516
Oct.	1—10	..	..	..	24,701	12,758	61,651	16,024
„	11—20	..	..	..	17,329	5,770	29,429	9,027
„	21—31	..	..	..	12,969	3,896	19,022	6,309

J. P. GUNN.

APPENDIX XII. (A).

Statement showing the 12 years (1923-34) average supply of the Sutlej, Chenab and Indus rivers at Ferozepur, Haveli, Panjnad and Sukkur respectively for ten-daily periods.

Month.	Ten daily periods.	Sutlej at Ferozepur Above.	Chenab.		Indus at Sukkur Above.
			Haveli or Trimmu.	Chenab component at Panjnad.	
1	2	3	4	5	6
September	1—10	80,738	108,635	129,222	399,639
	11—20	57,536	50,615	65,814	251,875
	21—30	33,790	28,956	35,007	160,053
October	1—10	25,612	15,818	20,245	106,050
	11—20	13,391	9,319	13,121	77,873
	21—31	9,344	6,077	9,245	63,021
November	1—10	7,519	5,338	6,991	53,994
	11—20	6,555	3,247	5,885	48,087
	21—30	5,910	2,458	4,767	42,867
December	1—10	5,864	3,221	4,312	39,135
	11—20	5,818	3,079	4,418	37,793
	21—31	5,403	2,539	4,130	37,049
January	1—10	5,427	2,581	3,893	35,343
	11—20	6,295	3,198	4,014	34,189
	21—31	5,929	4,127	4,925	34,532
February	1—10	6,104	5,610	6,184	33,826
	11—20	6,261	7,249	7,845	37,687
	21—28/29	6,206	6,863	7,890	36,663
March	1—10	6,253	9,032	7,788	37,174
	11—20	6,460	14,657	10,954	43,286
	21—31	6,629	16,439	13,526	46,790
April	1—10	6,684	20,587	16,938	55,207
	11—20	7,341	28,556	26,113	76,298
	21—30	9,044	41,241	32,700	83,954
May	1—10	10,157	42,300	35,290	95,343
	11—20	12,848	46,434	44,855	117,113
	21—31	14,692	50,466	44,706	127,032
June	1—10	21,709	64,083	52,161	164,264
	11—20	30,883	72,231	60,547	207,428
	21—30	45,936	90,027	70,734	258,875
July	1—10	64,871	103,354	87,664	313,281
	11—20	85,228	126,432	113,054	371,593
	21—31	114,339	138,495	136,148	432,442
August	1—10	126,619	140,103	155,787	486,840
	11—20	138,036	125,464	148,183	496,513
	21—31	119,949	108,661	130,886	455,513

APPENDIX XII. (B).

Statement showing the minimum ten-daily average supply of the 12 years (1923-34) period in the Sutlej at Ferozepur, Chenab at Haveli and Panjnad, and Indus at Sukkur.

Month. 1	Ten daily periods. 2	Sutlej at Ferozepur Above. 3	Chenab.		Indus at Sukkur Above. 6
			Haveli or Trimmu. 4	Chenab component at Panjnad. 5	
September	1—10	50,227	42,848	57,981	258,255
	11—20	27,043	18,914	35,127	158,128
	21—30	17,832	13,316	19,369	111,126
October	1—10	10,005	6,537	10,483	80,933
	11—20	7,506	3,720	5,290	61,491
	21—31	6,587	1,641	3,635	40,906
November	1—10	5,600	2,070	4,119	41,113
	11—20	5,420	1,748	3,021	37,025
	21—30	5,054	1,508	2,701	31,208
December	1—10	4,726	1,397	1,818	30,376
	11—20	4,216	1,150	1,092	26,436
	21—31	3,368	1,144	2,190	26,981
January	1—10	3,888	1,295	2,572	26,386
	11—20	4,161	1,037	2,206	25,008
	21—31	3,746	1,150	2,005	26,615
February	1—10	4,036	1,041	2,062	22,308
	11—20	3,325	882	1,861	22,767
	21—28/29	3,378	873	1,725	21,202
March	1—10	3,121	1,486	1,660	21,933
	11—20	3,166	1,860	2,743	22,649
	21—31	3,151	2,190	3,367	28,699
April	1—10	3,268	4,191	3,312	26,104
	11—20	3,216	9,995	5,599	30,455
	21—30	3,232	11,812	10,724	46,363
May	1—10	3,425	20,265	18,696	54,851
	11—20	3,323	14,752	14,569	48,225
	21—31	4,605	17,333	12,647	49,970
June	1—10	9,528	40,830	24,134	69,926
	11—20	15,017	47,650	42,249	135,080
	21—30	15,437	34,880	33,077	126,049
July	1—10	16,828	46,464	42,177	173,033
	11—20	48,554	57,312	55,339	202,479
	21—31	65,768	84,631	85,883	311,655
August	1—10	59,749	64,253	71,665	368,615
	11—20	70,816	75,000	67,495	323,208
	21—31	57,102	42,144	77,144	323,387

APPENDIX XIII.

LETTER FROM MR. R. T. HARRISON, SECRETARY TO THE GOVERNMENT OF BOMBAY, PUBLIC WORKS DEPARTMENT, TO THE DEPUTY SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF INDUSTRIES AND LABOUR, PUBLIC WORKS BRANCH, No. 2969-I., DATED THE 3RD./10TH. FEBRUARY 1925.

With reference to your letter, No. I.-61/2, dated 28th. November 1924, on the subject of the construction by the Government of the Punjab of an experimental section of the Thal Canal Project, I am directed by the Governor in Council to make the following observations.

2. In paragraph 3 of the Punjab Government's letter, No. 3723-N.I., dated 8th. November 1924, it is stated that it has been decided to construct a small canal taking out of the Indus near Kalabagh and discharging about 750 cusecs at head, and that no weir will be constructed on the river. Ordinarily this would mean that the experimental canal would be a purely inundation one; but owing to the unusual conditions which prevail near Kalabagh, or below the point of off-take of the proposed canal where it is believed a permanent shingle bar across the Indus exists, the canal may be able to get *rabi* water also, if its bed is put at a sufficiently low level, and therefore get a perennial supply even if no weir is constructed. The withdrawal of 750 cusecs will not have, at present, any perceptible effect on the existing inundation canals in Sind; but after the completion of the Lloyd Barrage Scheme, the abstraction of that discharge will certainly and very seriously affect the supplies of Sind canals during the *rabi* season. The attached table shows the deficiency in the *rabi* supplies of the canals of the Lloyd Barrage Scheme that will take place in January to March, and the figures therein indicate that rotations with the Punjab canal systems are likely to be necessary when the Sutlej Valley Project has been completed. The experimental canal must therefore accentuate the deficiency and tend to prolong the periods of rotation.

3. It has been contended that increased cultivation in the Punjab will result in increased seepage water entering the Indus and its tributaries and consequently compensate for the contemplated withdrawals in the *rabi* season. This theory must be regarded as pure conjecture and cannot be borne out by available data. On the other hand the accompanying sections showing the result of observations north of Sukkur between the Punjab boundary and Rohri, absolutely refute that contention. In the circumstances the only conclusion that can be arrived at is that any further withdrawals, however small, from the Indus and its tributaries by the Punjab Government during the *rabi* season will very seriously jeopardise the large and important interests involved in the Lloyd Barrage and Canals Project in particular, and Sind irrigation in general.

4. It is true that the present proposal is only for an experimental scheme to obtain reliable data for the larger one, the Thal Canal Project. But as soon as the experimental section proves successful the Punjab Government state that they will press for the construction of the Thal Canal. This intention has also been endorsed by His Excellency Sir Malcolm Hailey in his speech to the Punjab Council as quoted in the *Pioneer* of the 12th. November 1924. It is needless to point out that for this larger Thal Canal Project water will, without question, not be available.

5. In the circumstances mentioned above the Governor in Council is most strongly opposed to the proposed experimental scheme for the Thal area being sanctioned. In this connection he would again urge the most serious consideration of the facts and figures adduced in paragraphs 4 to 6 of this Government letter, No. 2969, dated 15th. May 1923, and express the earnest hope that no proposals whatever for further withdrawals from the Indus or its tributaries will be entertained by the Government of India until the Lloyd Barrage and Canal scheme has worked sufficiently long, and unless after its full development it can be proved that surplus water is available either during the *rabi* or early and late abkalan seasons, not only for the area served by that scheme but for lower Sind also.

M6CBI(WOP)

APPENDIX XIII—*contd.*

Accompaniment to Bombay Government letter, No. 2969-I., dated the 3rd. February 1925.

Probable Sukkur discharges after completion of the Sutlej Project.

Year.	January.						February.						March.					
	1.5	6.10	11.15	16.20	21.25	26.31	1.5	6.10	11.15	16.20	21.25	26. 28 29	1.5	6.10	11.15	16.20	21.25	26.31
1914 ..	22	23	24	23	23	21	19	19	20	21	25	23	22	23	24	26	23	25
1915 ..	22	21	21	22	20	20	21	23	24	25	27	27	27	24	29	30	31	30
1916 ..	24	25	25	26	27	28	23	19	24	23	22	21	21	22	21	19	24	28
1917 ..	19	17	17	18	19	20	21	22	20	19	18	17	17	17	16	17	19	19
1918 ..	23	22	21	20	20	21	20	19	19	19	18	18	20	21	22	25	35	46
1919 ..	20	20	20	19	19	18	18	23	28	27	38	33	28	27	26	54	59	82
1920 ..	40	35	24	22	21	20	26	21	20	19	17	16	15	16	20	22	37	46
1921 ..	19	68	18	18	23	22	22	21	25	23	22	21	21	20	18	22	27	35
Deficiency in required supply due to Sutlej Project.																		
1914 ..	1.0	..	..	..	..	1.5	3.5	3.5	2.5	1.5	..	..	0.5	..	..	..	2.0	2.0
1915 ..	1.0	2.0	1.5	0.5	2.5	2.5	..	..	..	..	..	..	..	..	..	..	..	..
1916 ..	..	..	..	..	..	..	..	3.5	..	..	0.5	1.5	1.5	0.5	2.0	5.0	1.0	..
1917 ..	4.0	6.0	5.5	4.5	3.5	2.5	1.5	0.5	2.5	3.5	4.5	5.5	5.5	5.5	7.0	7.0	6.0	8.0
1918 ..	..	1.0	1.5	2.5	2.5	1.5	2.5	3.5	3.5	3.5	4.5	4.5	2.5	1.5	1.0	..	..	..
1919 ..	3.0	3.0	2.5	3.5	3.5	4.5	..	..	..	..	..	..	..	..	..	..	..	..
1920 ..	..	..	..	0.5	1.5	2.5	..	1.5	2.5	3.5	5.5	6.5	7.5	6.5	3.0	2.0	..	..
1921 ..	4.0	5.0	4.5	4.5	..	0.5	0.5	1.5	..	..	0.5	1.5	1.5	2.5	5.0	2.0	..	..
Barrage re- quirements.	23	23	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	23	24	25	27

NOTE.—Figures in *italics* indicate interpolated discharges—ordinary type figures are actuals.

APPENDIX XIV.

Circular dated 5th. March 1935 from Independent Members to Interested Parties presenting POINTS FOR DISCUSSION.

The Independent Members of the Committee on the Distribution of the waters of the Indus and its Tributaries offer the following suggestions as its bases for discussion by the representatives of the Interested Parties.

From the hydrographs and other records examined they are of opinion that the water supplies at the critical points are sufficient to justify them in putting forward the suggestions below as a reasonable basis for solution of the problem.

In doing so the Independent Members have confined themselves strictly to principles leaving details to be worked out after the other Members have recorded their views on them.

I. *Khairpur*.—The allotment of water for the irrigation of Khairpur State to be on precisely the same footing as that of British Sind, having due regard to the principles which exclude areas from irrigation due to high water-table or similar causes.

II. *Sind*.—Sind to share the waters of the Indus with the Thal Project when constructed.

(a) In this connection the Independent Members are of opinion that the water supplies already guaranteed to Sind are unduly high, and will urge the necessity on several grounds of restricting water supplies to the minimum required for efficient irrigation. Nevertheless it is not proposed to reduce the project intensity or the maximum authorized discharges.

(b) The change in the authorized share of Khairpur will result in a reduction of the water allotted to it in kharif together with an allotment of rabi water. The amount of the allotment of rabi water will be added to the total authorized withdrawal at Sukkur.

(c) Thal and Sukkur will share shortage in proportion to the head capacity or authorized full supply discharge.

III. *Bahawalpur at Panjnad*.—The Independent Members are fully alive to the reasons which led to the restrictions on the withdrawals from the Chenab of the Bahawalpur canals at Panjnad. The settlement proposed in its entirety will remove the necessity for these restrictions. It is proposed, therefore, that the Bahawalpur canals at Panjnad and the Haveli project should share the available water strictly on a basis of their capacities or authorized full supply discharges. Hereafter the Bahawalpur canals at Panjnad will have no *claim* whatsoever on Sutlej water. Nevertheless, should surplus water pass below Islam, during a period when Haveli and Panjnad are below indent, then such supply will be taken into account when calculating relative shares of Haveli and Panjnad.

IV. *Bahawalpur on the Gharra reach*.—It appears clear that the supplies available to Bahawalpur on the basis of the existing agreement are unduly large and it is proposed to reallocate the waters available in the Gharra reach. The new capacities might be fixed on a basis of the areas, as accepted during the meetings of this Committee.

V. *Kharif Period*.—It appears to be the general view of the Committee that the kharif period in the West Punjab and Sind is approximately fifteen days later than in the rest of the Punjab. It is proposed that for all purposes the kharif period should be fixed from the 1st. of April to the 31st. of October, and that changes in authorized shares should take place on these dates.

F. ANDERSON.

F. A. BETTERTON.

APPENDIX XV.

Statement showing total withdrawals of the Chenab Inundation and Sidhnai Canals to be absorbed in the Haveli Project.

Month.	1922-23	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.
1	2	3	4	5	6	7	8	9	10	11	12	13	14
April .. { 1-15 ..	80	1,652	1,203	134	887	177	413	75	1,151	644	101	1,592	128
April .. { 16-30 ..	613	2,047	1,172	120	438	151	3,661	907	3,212	318	170	1,130	161
April .. { Mean ..	347	1,850	1,188	127	663	164	2,037	491	2,181	481	135	1,361	145
May	1,626	4,106	1,116	628	3,115	647	5,956	1,331	5,450	2,411	126	2,354	136
June	4,694	4,439	2,442	3,850	4,867	2,155	6,966	4,826	6,499	3,487	2,238	7,456	2,487
July	6,194	6,106	7,108	7,457	6,229	5,819	7,340	5,914	6,768	6,616	4,763	8,171	6,845
August	6,126	6,050	6,101	5,421	6,627	6,765	7,333	6,275	5,558	5,944	7,303	7,913	6,497
September	4,230	3,237	4,158	2,872	4,791	2,766	4,925	4,462	3,356	3,891	2,612	5,185	3,077
October { 1-15 ..	2,163	1,200	2,286	1,466	2,180	1,030	1,035	1,802	1,339	2,096	915	2,844	756
October { 16-31 ..	1,194	774	1,433	937	1,727	616	515	1,194	558	1,727	440	2,289	343
October { Mean ..	1,679	987	1,860	1,202	1,954	823	775	1,498	948	1,911	678	2,566	549

H. W. NICHOLSON.

APPENDIX XVI.

Statement of October withdrawals—Sukkur Barrage Canals.

Canal.	Authorized.		Revised.	Difference.	
				First fortnight.	Second fortnight.
Eastern Nara ..	British.	6,612	12,200	5,855	4,855
	Khairpur.	..	267		
		6,612	12,467*		
	British.	6,612	11,200		
	Khairpur	..	267		
		6,612	11,467†		
Rohri .. ..	..	10,480	10,470*	—10	—410
			10,070†		
North-Western .. ..	..	3,532	4,700*	1,168	668
			4,200†		
Dadu .. ..	..	2,273	3,300*	1,027	627
			2,900†		
Khairpur Feeders .. ..	..	3,000	2,688*	—312	—312
			2,688†		
Total ..	..	25,897	33,625	7,728	5,428
			31,325	Mean 6,578 caucs.	

* First fortnight.

† Second fortnight.

The October discharge included in the Sind revised requirements was 11,700 cusecs, *i.e.*, mean of 12,200 and 11,200 cusecs—requirements for the 1st half and the 2nd half of the month.

267 cusecs has been provided for Khairpur outlets on perennial discharge basis in place of 400 cusecs non-perennial previously given till September.

W. L. C. TRENCH.

APPENDIX XVII.

Statement comparing Panjnad, Haveli and Thal withdrawals, present and proposed.

Month.	Panjnad.			Haveli.			Thal.	Total.		
	Non-Perennial.	Perennial.	Total.	Non-Perennial.	Perennial.	Total.	Perennial.			
<i>Present</i>										
April	9,567	1,032	10,599	5,000	2,500	7,500	..	18,099		
May	9,567	1,032	10,599	5,000	2,500	7,500	..	18,099		
June	9,567	1,032	10,599	5,000	2,500	7,500	..	18,099		
July	9,567	1,032	10,599	5,000	2,500	7,500	..	18,099		
August	9,567	1,032	10,599	5,000	2,500	7,500	..	18,099		
September	9,567	1,032	10,599	5,000	2,500	7,500	..	18,099		
October	9,567	1,032	10,599	5,000	2,500	7,500	..	18,099		
November.. ..	..	516	516	..	1,250	1,250	..	1,766	
December .. ..	..	516	516	..	1,250	1,250	..	1,766	
January .. ..	..	516	516	..	1,250	1,250	..	1,766	
February .. ..	..	516	516	..	1,250	1,250	..	1,766	
March .. ..	..	516	516	..	1,250	1,250	..	1,766	
<i>Proposed.</i>										
April	6,500	1,500	8,000	5,000	2,750	7,750	6,000	21,750		
May	6,500	1,500	8,000	5,000	2,750	7,750	6,000	21,750		
June	6,500	1,500	8,000	5,000	2,750	7,750	6,000	21,750		
July	6,500	1,500	8,000	5,000	2,750	7,750	6,000	21,750		
August	6,500	1,500	8,000	5,000	2,750	7,750	6,000	21,750		
September	6,500	1,500	8,000	5,000	2,750	7,750	6,000	21,750		
October	6,500	1,500	8,000	5,000	2,750	7,750	6,000	21,750		
November.. ..	..	1,500	1,500	..	2,750	2,750	5,600	9,850	
December .. ..	..	750	750	..	825	825	2,000	3,575	
January .. ..	..	750	750	..	825	825	2,000	3,575	
February .. ..	..	1,000	1,000	..	825	825	3,600	5,425	
March .. ..	..	1,500	1,500	..	2,750	2,750	3,600	7,850	

Paharpur Canal { 500 kharif }
{ 250 rabi } Not addition.

T. A. W. FOY.

APPENDIX XVIII.

Statement showing monthly mean allotments for Khairpur Feeders.

Month.								Monthly mean cusecs.
April	..	..	..	..	..	..	..	1,000
May	..	..	..	..	..	..	..	2,250
June	..	..	..	..	..	..	..	3,000
July	..	..	..	..	..	..	..	4,000
August	..	..	..	..	..	..	..	4,000
September	..	..	..	..	..	..	..	4,000
October	..	..	..	..	..	..	..	2,675
November	..	..	..	..	..	..	..	2,675
December	..	..	..	..	..	..	..	2,625
January	..	..	..	..	..	..	..	2,000
February	..	..	..	..	..	..	..	2,000
March	..	..	..	..	..	..	..	2,000

The rabi mean supply based on Rohri canal rabi capacity factor, for Khairpur Feeders, should be 2,429. Against this the State asks for 2,329 cusecs.

W. L. C. TRENCH.

J. M. SLADEN.

APPENDIX XIX.

Statement showing supplies required for Punjab Projects.

(Discharge in cusecs.)

Month.				Haveli Project.				Thal Project.					
				Non-perennial. Mean & Max.	Perennial.		Total.		Mean.	Max.			
					Mean.	Max.	Mean.	Max.					
January	..	..	..	825	2,750	825	2,750	2,000	6,000	
February	..	..	..	825	2,750	825	2,750	3,600	6,000	
March	..	..	..	2,750	2,750	2,750	2,750	3,600	6,000	
April	{	1-15th.	..	..	2,750	2,750	{	2,750	6,000	6,000	
		16-30th.	..	{	5,000	2,750	2,750	{	7,750	7,750	6,000	6,000	
May	..	..	..	5,000	2,750	2,750	7,750	7,750	6,000	6,000
June	..	..	.	5,000	2,750	2,750	7,750	7,750	6,000	6,000
July	..	..	..	5,000	2,750	2,750	7,750	7,750	6,000	6,000
August	..	..	..	5,000	2,750	2,750	7,750	7,750	6,000	6,000
September	..	..	..	5,000	2,750	2,750	7,750	7,750	6,000	6,000
Octr.	{	1-15th.	5,000	2,750	2,750	{	7,750	{	7,750	6,000	6,000
		16-31st.	2,750	2,750	{	2,750	{	2,750	6,000	6,000
November	..	..	..	..	2,750	2,750	2,750	2,750	5,600	6,000
December	..	..	..	..	825	2,750	825	2,750	2,000	6,000

H. W. NICHOLSON.

APPENDIX XX.

Explanation of the method of derivation of the diagram (Plate II) showing the variation of the kharif duties at distributary head with the capacity per thousand acres at distributary head.

Points 1 to 12 are taken from data given in the Bikaner BRIEF, Annexure G, and derived originally from Punjab Printed Statistics.

Calculations for other points below—

Dipalpur Canal.

Year.	Kharif Duty.	C. C. A.	Discharge at Disty. Head.
1932-33	63	987,000	5,926
1931-32	50	980,664	6,215
1930-31	59	987,742	6,074
1929-30	66	988,198	6,074
Mean	59.5	985,901	6,072

Allowance per 0/00 acres C. C. A. = 6.16

Mailsi Canal.

Year	Kharif Duty.	C. C. A.	Discharge at Disty. Head.
1932-33	67	738,604	4,582
1931-32	56	738,604	4,567
1930-31	67	738,604	4,670
1929-30	82	725,338	4,518
Mean	68	735,288	4,584

C. C. A. 735,288

Uncolonized 39,220

Net 696,068

Capacity 0/00 acres = 6.59

14. *Bikaner Canal.*

Year.	Kharif Duty.
1928	114
1929	143
1930	131
1931	91
1932	109
1933	123
1934	127
Mean	120

Area settled & occupied = 580,339

Authorized Distributary Discharge = 1,939

Capacity per 1,000 acres C. C. A. = 3.52

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APPENDIX XX—*contd.*16. *Pakpattan Non-Perennial.*

Year.	Kharif Duty.	C. C. A.	Discharge at Disty. Head.
1932.. .. .	70.4	336,000	2,055
1931.. .. .	62.0	331,263	1,983
1930.. .. .	62.0	331,263	1,983
1929.. .. .	78.0	331,263	1,983
Mean	68	332,447	2,001

Capacity 0/00 acres .. =6.10

19. *Pakpattan Perennial.*

Year.	Kharif Duty.	C. C. A.	Discharge at Disty. Head.
1932.. .. .	93.5	889,000	2,658
1931.. .. .	94	893,935	2,782
1930.. .. .	113	771,330	2,454
1929.. .. .	159	755,677	..

Area uncolonized.

1932 777,143—461,087 =316,056

1931 777,143—430,211 =346,932

Area occupied.

1932 889,000—316,000 =573,000

1931 894,000—347,000 =547,000

Capacity 0/00 acres at Disty. Head of the C. C. A. effectively occupied.

1932 4.64 cusecs.

1931 5.10 cusecs.

17. *Fordwah.*

Year.	Kharif Duty.	C. C. A.	Discharge at Disty. Head.
1932.. .. .	42	402,377	2,831
1931.. .. .	43	402,377	2,831
1930.. .. .	42	402,377	2,737
1929.. .. .	45	447,086	2,737
Mean	43	413,554	2,784

Capacity 0/00 acres C. C. A. .. =6.72

APPENDIX XXI. (A).

LETTER No. 14-1.

GOVERNMENT OF INDIA,
PUBLIC WORKS DEPARTMENT,
Civil Works—Irrigation.
Delhi the 10th. January 1921.

FROM

COLONEL SIR S. D'A. CROOKSHANK, K.C.M.G., ETC.,
*Secretary to the Government of India,
Public Works Department.*

To

THE SECRETARY TO THE GOVERNMENT OF THE PUNJAB,
Public Works Department, Irrigation Branch.

SIR,

I am directed to forward herewith a copy of a note by the Inspector General of Irrigation on the urgency of securing accurate gaugings of the Indus river and its tributaries.

The importance of this question has lately become evident in connection with the two great projects for the Sukkur Barrage and Canals and for the Sutlej Valley Canals, and it is extremely necessary, if fruitless controversy is to be avoided in the future, for accurate data on the subject to be obtained. I am therefore to request that, with the permission of the Governor in Council, the Government of the Punjab will place themselves in communication with the Government of Bombay at the earliest possible opportunity, with a view to giving effect to the suggestions made in paragraphs 8 and 9 of the note. I am further to ask that the names of the executive officers, when appointed, may kindly be reported to the Government of India and that steps may be taken towards the formation of the Committee proposed by the Inspector General of Irrigation. The report of the Committee should be forwarded annually to the Government of India for information.

The Government of India fully endorse the remarks of the Inspector General in regard to the urgency of the investigation and are confident that they will receive the whole-hearted co-operation of both local Governments in their desire to place the question of the future distribution of the Indus supplies beyond the possibility of uninformed controversy.

I have the honour to be,

SIR,

Your most obedient servant,

S. D'A. CROOKSHANK.

*Colonel,**Secretary to the Government of India*

APPENDIX XXI. (B).

Note, dated the 10th. December 1920, by Sir Thomas Ward, Kt., C.I.E., M.V.O., Inspector General of Irrigation in India, on the urgency of the accurate gauging of the Indus river and its tributaries.

1. The Government of India have recently had under their consideration two irrigation projects of the first magnitude, for the Sukkur Barrage and Canals in Sind, and for the Sutlej Valley Canals in the Punjab. As the former project will draw its supplies from the Indus and the latter from a tributary of the same river, it was necessary to examine the question of the effect of the withdrawals proposed in the Punjab upon the supplies available at Sukkur before the Government of India could recommend to the Secretary of State that both schemes should be taken in hand simultaneously.

2. *Prima facie*, it is logical to assume that the abstraction of water from the tributaries of the Indus must necessarily diminish the volume passing Sukkur, but it is quite possible that this diminution is to some extent compensated for by seepage back into the river, during the rabi season, of a portion of the enormous withdrawals made by the Punjab during the kharif. Unfortunately the data available are too meagre to permit of a definite conclusion being arrived at on the subject. Such records of discharges as exist have, however, been carefully examined and analysed, and, on the information before them, the Government of India are satisfied that the Sutlej Valley Project can be put in hand without prejudicing the supplies necessary to secure the area of irrigation contemplated on the Sukkur Canals.

3. More than this it is impossible to assert, and the question of the collection of reliable data for the disposal of the problem has become one of the first urgency. It will obviously be necessary, once construction commences on the Sukkur scheme for any future projects put forward by the Punjab to be very carefully examined in relation to the possible effects of further withdrawals from the tributaries of the Indus upon the rights to irrigation from the Sukkur Canals upon which the Government of Bombay are now entering. I have no hesitation in saying that the data for such an examination do not at present exist, and that, unless steps are immediately taken to collect and collate them, endless difficulty is likely to ensue. Almost all the controversies which have up to date taken place in India in respect of questions of water-rights have been directly attributable to the fact that adequate figures were not forthcoming and that consequently recourse had to be had to indirect deductions and presumptions; the only method of averting such controversies is to have at hand reliable information on the factors in the case.

4. The problem which has to be solved in this instance is the determination of the natural supplies in the Indus and of the diminution or increase which takes place in these supplies consequent on the withdrawal of water for irrigation in the Punjab and the seepage of a portion of such withdrawals back into the rivers. This can only be done by careful gauging of the streams concerned; and it is this gauging which I would urge should at once be taken in hand in a systematic and scientific manner.

5. A certain amount of gauging* is at present undertaken both at the headworks of the various canals in the Punjab and at various intermediate discharge sites, but examination of the results has shown that the records are not systematically kept and are not reliable in all cases. What is required is that a list of gauging sites should be drawn up, and that continuous observations should be made at them over a protracted period. In the table accompanying I have listed the sites which, if adopted, appear to me likely to give the material required.

6. This list is less formidable than might appear at first sight since gaugings, in some cases continuous, in others periodical, are already made at 16 out of the 23 sites proposed. At such stations all that will be necessary will be to arrange for continuous gaugings being made and to ensure that as accurate results as possible are obtained from them.

7. In addition to the gauging of the rivers, accurate measurements of the withdrawals by all canals, both in British and Bahawalpur territory, will require to be made.

8. In my opinion the best results will be achieved by the Bombay and Punjab Governments each appointing a special executive officer to deal with the work. In the Punjab the officer selected would be directly responsible for the gaugings at the seven new stations proposed, and would receive those from the other stations from their respective Executive Engineers. He would have no responsibility as to the latter but would visit the gauging sites from time to time and, as an expert, make suggestions so as to ensure the utmost accuracy possible being attained. He would also check, by means of reliable current meter observations, the results obtained at such stations with the object of determining the co-efficient, if any, to be applied to them. It will be for the Government of Bombay to decide whether the Bombay officer should be in direct charge of the gauging parties at Mithankot, Sukkur and Kotri, the responsibility for which rests, at present, with the Indus River Commission.

*This information would be considerably more useful if discharge diagrams were substituted for the raise and fall diagrams now published.

APPENDIX XXI. (B)—*contd.*

9. But the main work of these officers would be the tabulation, co-ordination and scrutiny of the results obtained. For this purpose they would be required to meet at frequent intervals, probably every month, to discuss results. I would further propose that they should be required to report to a Committee, which should meet every year, consisting of the Chief Engineer, Bombay, the Chief Engineer in Sind, the two Punjab Chief Engineers and the Inspector General of Irrigation as Chairman, with power to add to their numbers. This Committee would review the report of the two executive officers and this review, together with the report and tables and diagrams of the observations made, would be printed and submitted annually to the Government of India.

10. I have referred above only to the question of the distribution of water as between the Punjab and Sind, but the same investigation should give valuable results as to apportionment between the various projects in the former province and between Upper and Lower Sind in the latter. I do not propose, in this note, to deal with this aspect of the question nor need I refer to the valuable information likely to be obtained by a careful investigation of the subsoil conditions *underlying the Punjab doabs*. *It will, however, be obvious that the Committee suggested above will be in a position to give material assistance to Government in respect of any case in which these points are under discussion.*

11. There are two points to which I would specially invite attention. The first is the extreme importance of the work to all the parties concerned, to the Government of the Punjab because all future schemes in that province will have to be examined with an eye to the rights of Sind to irrigation, to the Government of Bombay because projects for extensions in Sind will similarly have to be analysed with reference to the prescriptive rights which would thereby be acquired by them as against the Punjab, to the possible prejudice of extensions in that province, and to the Government of India as arbiter in inter-provincial differences. This importance should be clearly kept in mind when officers are being appointed to the work, such officers being selected for their special abilities as men likely to take a keen and scientific interest in their duties, and should also be impressed upon all those Executive Engineers who will be responsible for individual gauging stations, upon the results obtained at which the special officers must largely depend for their data.

12. The second point is the desirability of continuous daily observations of discharges. From personal experience in Seistan and Siam I am convinced that in no other way can reliable results be obtained and no trouble is too great when compared with the advantages gained from complete continuity of observations. I would strongly advocate the observation of daily discharges (not merely gauge readings) at all the stations selected, current meter observations being made at the more important ones, frequent discharges should also be taken to check the volume of the withdrawals, the canal-head discharge curves being recalibrated where necessary. Only in this way will finality be reached.

13. I am aware that considerable trouble and expense will be involved by these suggestions but both trouble and money will have been expended to the best possible advantage if the fruitless discussions, which are otherwise bound to arise between Sind and the Punjab, are averted and the consequent delays in the development of irrigation obviated.

True Copy.

W. R. CHAMBERS,

Superintendent, Government of India,

Public Works Department.

APPENDIX XXI. (B).—contd.

List of sites referred to in paragraph 5 of Note, dated 10th. December 1920, by Sir T. R. J. Ward,
Inspector General of Irrigation.

Serial No.	River.	Site.	Officer responsible.
1	Jhelum	Mangla	Executive Engineer, Mangla.
2	Do.	Rasul	Do. Rasul.
3	Jhelum Chenab Chenab	Above junction with Chenab. Above junction with Jhelum. Haveli.	Special Executive Engineer.
4	Chenab	Marala	Executive Engineer, Marala.
5	Do.	Khanki	Do. Khanki.
6	Ravi	Madhopur	Do. Madhopur
7	Do.	Balloki	Do. Balloki.
8	Do.	Sidhnai	Do. Sidhnai.
9	Chenab	Sher Shah	Do. Multan.
10	Beas	Pang	Special Executive Engineer.
11	Beas Sutlej Do. Do.	Above junction with Sutlej. Gidar Pindi bridge. Western Bein. Eastern Bein.	Do. do.
12	Do.	Bhakra	Executive Engineer, Rupar.
13	Do.	Rupar	Do. do.
14	Do.	Gandasinghwala	Executive Engineer, Upper Sutlej.
15	Do.	Salmanke	Special Executive Engineer.
16	Do.	Jamlara	Do. do.
17	Do.	Adamwahan	Executive Engineer, Lower Sutlej.
18	Chenab	Panjnad Weir*	Special Executive Engineer.
19	Indus	Kalabagh	Do. do.
20	Do.	Ghazi Ghat (Dera Ghazi Khan)	Executive Engineer, Dera Ghazi Khan.
21	Do.	Mithankot	Indus River Commission.
22	Do.	Sukkur	Do.
23	Do.	Kotri	Do.

*The conditions at this site are very exceptional, lying as it does immediately below the confluence of two large rivers, and it is very important that continuous detailed discharges should be made there by a competent observer as physical problems of considerable difficulty may be apprehended in the designing and siting of the proposed weir.

APPENDIX XXII.

TABLE I.

Statement showing monthly mean allotments for Khairpur Feeders.

Month.									Monthly mean (cusecs).
April	..	..	..	..	..	..	..	..	1,000
May	..	..	..	..	..	..	..	..	2,250
June	..	..	..	..	..	..	..	..	3,000
July	..	..	..	..	..	..	..	..	4,000
August	..	..	..	..	..	..	..	..	4,000
September	..	..	..	..	..	..	..	..	4,000
October	..	..	..	..	..	..	..	..	2,675
November	..	..	..	..	..	..	..	..	2,675
December	..	..	..	..	..	..	..	..	2,625
January	..	..	..	..	..	..	..	..	2,000
February	..	..	..	..	..	..	..	..	2,000
March	..	..	..	..	..	..	..	..	2,000

. The rabi mean supply for Khairpur Feeders based on Rohri Canal rabi capacity factor should be 2,429. Against this the State asks for 2,329 cusecs.

APPENDIX XXIII.

TABLE II.

Showing present authorized withdrawals of and those proposed to be authorized for Sind and Khairpur.

Month.	Present authorized withdrawals.				Withdrawals proposed to be authorized.			
	British.	Nara for Khairpur lands.	Khairpur East and West Feeders.	Total.	British.	Nara for Khairpur lands.	Khairpur East and West Feeders.	Total.
1	2	3	4	5	6	7	8	9
January ..	22,656	..	..	22,656	22,656	267	2,000	24,923
February ..	22,656	..	..	22,656	22,656	267	2,000	24,923
March ..	23,454	..	..	23,454	23,454	267	2,000	25,721
April ..	26,629	400	2,000	29,029	26,629	267	1,000	27,896
May ..	36,143	400	3,000	39,543	36,143	267	2,250	38,660
June ..	41,496	400	4,030	45,926	41,496	267	3,000	44,763
July ..	41,496	400	4,030	45,926	41,496	267	4,000	45,763
August ..	41,496	400	4,030	45,926	41,496	267	4,000	45,763
September ..	41,496	400	4,030	45,926	41,496	267	4,000	45,763
October ..	22,897	..	3,000	25,897	29,397	267	2,675	32,339
November ..	20,540	..	3,000	23,540	20,540	267	2,675	23,482
December ..	22,656	..	3,000	25,656	22,656	267	2,625	25,548

APPENDIX XXIV.

TABLE III.

Panjnad.

(Discharge in cusecs.)

Month.				Capacity.			Monthly mean with- drawals.	Maximum authorized with- drawals.
				Non- perennial.	Perennial.	Total.		
1				2	3	4	5	6
January	..	..	..	..	1,500	1,500	..	1,500
February	..	..	..	..	1,500	1,500	..	1,500
March	..	..	..	..	1,500	1,500	..	1,500
April	..	1—15th	..	..	1,500	1,500	..	1,500
		16—30th	..	6,500	1,500	8,000	..	8,000
May	..	..	..	6,500	1,500	8,000	..	8,000
June	..	..	..	6,500	1,500	8,000	..	8,000
July	..	..	..	6,500	1,500	8,000	..	8,000
August	..	..	..	6,500	1,500	8,000	..	8,000
September	..	..	..	6,500	1,500	8,000	..	8,000
October	..	1—15th	..	6,500	1,500	8,000	..	8,000
		16—31st	..	6,500	1,500	1,500	..	1,500
						6,500		6,500
November	..	..	..	..	1,500	1,500	..	1,500
December	..	..	..	..	1,500	1,500	..	1,500

APPENDIX XXV.

TABLE III (AMENDED.)

Panjnad.

(Discharge in cusecs).

Month.				Capacity.			Monthly mean withdrawals.	Maximum authorized withdrawals.
				Non-perennial.	Perennial.	Total.		
1				2	3	4	5	6
January	..	..	..	..	1,500	1,500	{ 1-14 1,000 15-28 1,500	1,500
February	..	..	..	..	1,500	1,500		1,500
March	..	..	..	..	1,500	1,500		1,500
April	1-15th ..			*6,500	1,500	1,500		1,500
						*6,500	*6,500	*6,500
	16-30th ..			6,500	1,500	8,000	8,000	8,000
May	..	..	..	6,500	1,500	8,000	8,000	8,000
June	..	..	..	6,500	1,500	8,000	8,000	8,000
July	..	..	..	6,500	1,500	8,000	8,000	8,000
August	..	..	..	6,500	1,500	8,000	8,000	8,000
September	..	..	..	6,500	1,500	8,000	8,000	8,000
October	1-15th ..			6,500	1,500	8,000	8,000	8,000
	16-31st ..			*6,500	1,500	1,500	1,500	1,500
						*6,500	*6,500	*6,500
November	..	..	..	..	1,500	1,500	1,500	1,500
December	..	..	..	..	1,500	1,500	1,000	1,500

* See paragraph 22 (Proc. 1144).

APPENDIX XXVI.

TABLE IV.

Statement showing supplies required for Punjab Projects.

(Discharge in cusecs.)

Month.	Haveli Project.						Thal Project.	
	Non-perennial mean and max.	Perennial.		Total.		Mean.	Max.	
		Mean.	Max.	Mean.	Max.			
January .. ..	..	*825	2,750	*825	2,750	2,000	6,000
February .. ..	..	*825	2,750	*825	2,750	3,600	6,000
March .. ..	..	2,750	2,750	2,750	2,750	3,600	6,000
April—								
1st—15th .. ..	..	2,750	2,750	2,750	2,750	6,000	6,000
16th—30th	5,000	2,750	2,750	7,750	7,750	6,000	6,000	
May	5,000	2,750	2,750	7,750	7,750	6,000	6,000	
June	5,000	2,750	2,750	7,750	7,750	6,000	6,000	
July	5,000	2,750	2,750	7,750	7,750	6,000	6,000	
August	5,000	2,750	2,750	7,750	7,750	6,000	6,000	
September	5,000	2,750	2,750	7,750	7,750	6,000	6,000	
October—								
1st—15th	5,000	2,750	2,750	7,750	7,750	6,000	6,000	
16th—31st .. ..	..	2,750	2,750	2,750	2,750	6,000	6,000
November .. ..	..	*2,750	2,750	*2,750	2,750	5,600	6,000
December .. ..	..	*825	2,750	*825	2,750	2,000	6,000

*Eventually changed to 2,475 cusecs for November, and 990 cusecs for December, January and February. and accepted. (See also Table VI.)

APPENDIX XXVII.

TABLE V.

Sutlej Gharra reach.

Partner.	Perennial capacity.		Non-perennial share capacity.		Total.		Non-perennial additional capacity.	Total Maximum capacity.
	Cusecs.	Per cent.* rounded.	Cusecs.	Per cent.* rounded.	Cusecs.	Per cent.* rounded.	Cusecs.	Cusecs.
1	2	3	4	5	6	7	8	9
Punjab ..	3,940	30%	11,523	72%	15,463	53%	5,761	21,224
Bahawalpur ..	6,340	49%	4,467	28%	10,807	37%	2,233	13,040
Bikaner ..	2,720	21%	Nil	..	2,720	10%	..	2,720
Total ..	13,000	..	15,990	..	28,990	..	7,994	36,984

* Percentage shares of total supplies utilized in canals.

APPENDIX XXVIII.

TABLE VI.

Capacity Factors.

Month.	Sind.	Punjab existing.	Thal.	Panjnad.		Haveli.
				Table III.	Proposed.	
1	2	3	4	5	6	7
October	·90	·85	1·0	1·0	1·0	1·0
November	·81	·55	·93	1·0	·9	1·0
December	·89	·4	·3	·66	·5	0·3
January	·79	·4	·3	·66	·5	0·3
February	·79	·5	·6	·66 } 1·0 }	·66	0·3
March	·81	·65	·6	1·0	*·75	1·0

* This was changed later to ·85 by Sir Bernard Darley and accepted by the Committee.

† Eventually changed to ·9 for November and ·36 for December, January and February, and accepted.
(See also Table IV.)

APPENDIX XXIX.

Copy of letter from the Government of India to the Punjab Government.

No. 15-I.

GOVERNMENT OF INDIA,
PUBLIC WORKS DEPARTMENT,

Civil Works—Irrigation.

FROM

COLONEL SIR S. D'A. CROOKSHANK, K.C.M.G., ETC.,
*Secretary to the Government of India,
Public Works Department.*

TO

THE SECRETARY TO THE GOVERNMENT OF THE PUNJAB,
*Public Works Department,
Irrigation Branch.*

Delhi, the 11th. January 1921.

SIR,

I am directed to refer to your letter No. 01209 W. I., dated the 8th. September, 1920, with which the estimate of the Sutlej Valley Canals Project was forwarded for sanction.

The Government of India have given the project their careful consideration and it has been reviewed and satisfactorily reported upon by Sir Thomas Ward, their late Inspector General of Irrigation. There are, however, certain points dealt with in his report upon which the Government of India desire to elicit a definite expression of the opinion of the local Government before the project is forwarded to the Secretary of State.

They wish to be assured, in the first instance, that, in the negotiations with the States, no undue concessions were made, to the detriment of the British interests in the project, with a view to a settlement being reached. They notice, for example, that it is proposed to give only non-perennial irrigation in the existing British inundation areas and will be glad to know whether the restriction of irrigation in these tracts to the months of April to October is due to the fact that perennial irrigation would be harmful, as leading to possible water-logging and that a first watering will suffice for their needs or whether this restriction is merely due to shortage of water during the rabi months owing to the requirements of the States having to be met. They further observe that a certain area of inundation irrigation in Bahawalpur is to be converted into perennial but that none of the British area is similarly treated: they are informed by their advisers that this is due to the tract in question lying in the higher land and that, wherever similar conditions exist in British territory, the same procedure will be adopted. No figures are, however, given for the British area of this nature, as is done in the case of Bahawalpur, but the index map appears to support the explanation given above; I am to ask whether it is correct.

As regards perennial irrigation, the Government of India will be glad of an assurance from the local Government that water is being provided for the whole culturable area of the Nili Bar and that the concession made in reducing the area within irrigation limits will not result in any culturable land being omitted from the scheme.

Turning now to the question of intensities, I am to ask whether the Punjab Government is fully satisfied that the intensities adopted in the project estimate are such as will ensure optimum conditions of cultivation in the British tracts affected. It is noticed that, owing to extra water being made available in the Sutlej by the inclusion of the Panjnad weir in the project and to this water being allocated to the two States the intensity in the States is higher than that in British territory. I am to enquire whether this concession is detrimental to the British interests or whether the amount allocated to the Nili Bar in the project is as much as can economically be utilized therein.

In general, the Government of India desire to be assured that the Punjab Government are convinced that, under the project as now submitted, they have obtained the supplies necessary for the irrigation, to the full economical extent, of the whole commanded area in British territory.

I am further to enquire whether the local Government are satisfied that they have now the right to proceed with further developments of irrigation on the Sutlej, such as the Bhakra Dam Project, without any possibility of fresh opposition from the Bahawalpur Durbar. The drafting of the Agreement with the States does not appear to be altogether satisfactory; Clause 4 A which relates to the point in question is ambiguous as it does not expressly state whether the "Irrigation requirements" mentioned include future as well as existing requirements. The provision of the Clause which limits the claims of the parties upon the Gharra water to the canal head capacities specified in the project appears to be of greater importance than the reference to the source of supply. Possibly Clause 27 is intended to cover new works, though this is not distinctly stated. I am to ask that the local Government will kindly review the matter and inform the Government of India whether, in their opinion, the interests of future projects are sufficiently protected by the agreement as now framed.

Finally I am to ask that, with the permission of the Governor in Council, the reply to this letter may be forwarded at the earliest possible date so as not to delay the submission of the project to the Secretary of State.

I have the honour to be,

SIR,

Your most obedient servant,

S. D'A. CROOKSHANK,

Colonel,

Secretary to the Government of India.

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Woolar Lake Project	25 25	48 50	36	16—19	849—850	1153

ERAG INDUS

90,000

80,000

henab at (Above

70,000

60,000

50,000

40,000

30,000

20,000

10,000

Minimum out of 12 y r (1923 34.)

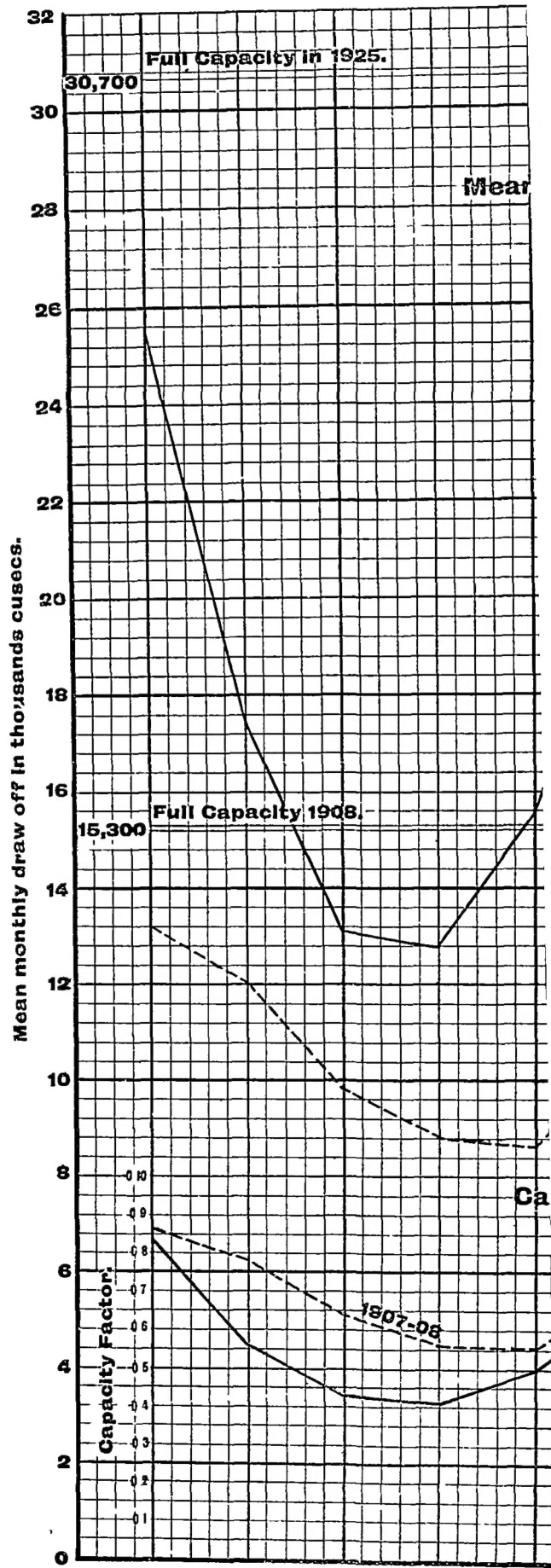
95,343
117,113
127,032
164,264
207,428
258,875
313,281
371,593
432,442
486,840
496,513
455,513
0

Decr. Jan June by. March April May June July Augt.

135,080
125,049
173,033
202,479
311,655
368,615
323,208
323,387
Minimum.

WEIR CONTROLLED CANAL

A1



	Octr.	NOVR	DECR	JANY.	FEBY.
	½ Octr	↓	↓	↓	↓
Haveli Perenl	2,750	2,750	825	825	82
Thal.	6,000	5,600	2,000	2,000	3,60
Total.	8,750	8,350	2,825	2,825	4,42
Deduct already agreed to.	1,250	1,250	1,250	1,250	1,25
Additional reqd.	7,500	7,100	1,575	1,575	3,171